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The Institute of Vitreous Enamellers
The National Ironfounding Employers' Federation
The Welsh Engineers' and Founders' Association
and
The Foundry Trades' Equipment and Supplies Association

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An Ancient Monument and a New Development

We referred some time ago to efforts that were being made to have the bridge in cast iron at Ironbridge scheduled as an ancient monument. These efforts have been crowned with success, and this, the first bridge in the world to be constructed in cast iron, is to be preserved. This step indicates a very praiseworthy broadness of mind on the part of the Office of Works, for the structure, first opened to traffic in 1779, is only a matter of 156 years old, and that, as ancient monuments go, is a mere nothing, although it comprehends the whole of the astonishing development of the iron and steel industry. The changing conditions of traffic have caused concern for some time to the Shropshire County Council, but under the arrangement now made a new steel bridge will be built, three-quarters of the cost being met from the Road Fund, and the old bridge left intact. The bridge was praised as a structure by both Stephenson and Telford, and it will remain an inspiration to founders all over the world as the very cradle of their art.

Another interesting link with early history is recalled by the opening at the Clyde Iron Works of Colvilles, Limited, at Tollcross, of the first mechanically-charged blast furnace in Scotland. We have related at various times how the great Carron works was founded after the successful establishment of ironfounding in Shropshire. The Clyde works was an offshoot of the Carron works, started in 1786, as an ironfoundry, but the original interests were acquired by Mr. Dunlop in 1810. His successor, James Dunlop, recorded that in 1811 the works made nearly 2,500 tons of pig-iron, at a cost of nearly eleven tons of coal for each ton of pig-iron. In 1828 the output was more than doubled, just over eight tons of coal per ton of pig-iron being needed. By 1832 the hot blast was in operation. Nearly 12,000 tons were produced at about two and a-half tons of coal per ton of pig. After a period in the control of Lithgow's the works passed in 1931 to Colvilles, Limited, and a new chapter in the production of pig-iron in Scotland has been opened. We hope that the enterprise will vindicate the faith of its promoters and that the somewhat pessimistic views of the future of Scottish pig-iron held in some quarters will be falsified. The foundry world could ill afford to lose "Scottish" pig-iron.

New Factories

Statistics* have just been published which show that 478 new factories were erected in the United Kingdom during 1934, which found employment for 37,200 workpeople, and of these more than 40 per cent. were established in the London area.

During the year there were 144 factory extensions, whilst 515 factories were closed. The closing of factories naturally involves a certain amount of unemployment, but in no way are the figures comparable with those related to new establishments because, in many cases, the closing down of a factory is a prolonged process, often occupying several years. It should be realised that a fair number of closures—something of the order of 20 per cent.—were due to works being transferred to another area or to another factory under the same ownership. The extremely stable conditions within the iron foundry industry is revealed by the fact that in the two years, 1933 and 1934, there were six new works created, five were extended, and twelve were closed.

The Government representatives have been able in practically 300 cases to collect reasons for the choice of site. These have been classified, and the results have definitely negatived all the erudite reasoning which has from time to time been expounded by economists of international reputation. In more than 50 per cent. of the cases, convenience of premises was ascribed as the reason for the choice of site. Such factors as "proximity to markets"; "proximity to factories in the same industry," and "accessibility of raw materials" were given as the cardinal reason in about 10 per cent. of the cases. In four cases, economics went by the board entirely, as the employer chose a works near to his own residence! After all, there is much to commend such an action.

As a means for the extension of one's business, we know of no pamphlet more useful than this survey, as most foundries cater for one or several consuming industries, and herein are listed on sixteen pages the location of all factories opened, extended, closed and transferred during last year. For instance, if a foundry makes brick presses, it will find that many new works have come into being. The same remark applies to those making palette plates, and many other lines. For anyone familiar with the industrial conditions of Great Britain, this booklet is certainly an interesting study.

* Survey of Industrial Development, 1934. Published by H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2. Price 9d. net.

A New British Electro-magnetic Fatigue Tester

A new type of fatigue tester that provides a life test on sample steel bars and can also be adapted for testing non-magnetic metals has recently been developed by Salford Electrical Instruments, Limited, an associated company of the G.E.C. In this apparatus the sample bar or rod is supported at its two nodes and vibrated electro-magnetically so that it resonates, a method that allows a very great number of cycles of stress to be applied to the bar in a relatively short time. By measuring the deflection of the bar at an antinode, the actual stress applied can be calculated using the modulus of elasticity E, which can be determined from the frequency of the vibrating bar; the number of cycles

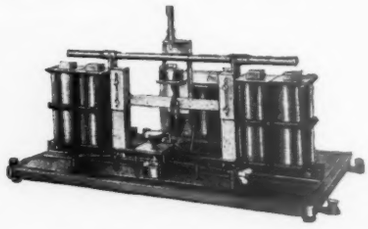


FIG. 1.—BAR HOLDER AND ELECTRO-MAGNETS.

applied to the test-bar before failure can be indicated by a recorder. It may also be noted that a means of tripping the whole gear is provided to operate on the occurrence of a crack in the specimen. More than one bar may be vibrated at once by providing several units, and the different failure times caused by varying the stress on each can all be indicated on the chart of one recorder.

The complete apparatus comprises three parts:—(1) the bar holder and electro-magnets; (2) the power supply unit, and (3) the recorder (not essential). The first two items are illustrated in Figs. 1 and 2 respectively.

The bar (of whatever material) is supported in vee notches and is rubber covered at these

FIG. 2.—POWER SUPPLY UNIT.

points to obviate chattering due to the imperfection of the mechanical contact. For non-ferrous metals, it is necessary to provide steel sleeves over the test bar in the region of the exciting magnets, and a small steel clip in the centre for the pick-up.

The electrical circuit uses an a.c. supply, which is transformed for filament heating and rectified for supplying the gas-filled relay anode and the d.c. polarising magnets. The electro-magnets for vibrating the bar consist of two pairs of coils on two iron circuits. One pair of these coils is excited by d.c. and provides a constant polarising field. The other pair is excited by alternating current from the gas-filled relay circuit, in which the relay with its condensers and inductances forms a variable frequency oscillator. This oscillator can be adjusted so that the electrical frequency corresponds to the mechanical natural

(*Continued at foot of next column.*)

frequency of the bar; when this occurs the bar resonates with a relatively large amplitude and is held in synchronism (vibrating at the same amplitude even when the applied voltage varies or the circuit constants alter slightly) by means of a pick-up under the centre of the bar, which is connected in the grid circuit of the relay.

In order to trip the circuit on a crack occurring an auxiliary vibrator is provided. This vibrator comprises a length of steel spring, the tension of which can be adjusted to vary the natural frequency, and is excited from the same circuit as the main a.c. coils; after tuning the main circuit the auxiliary vibrator is tuned by varying the tension and then detuned slightly by a half-turn backwards of the tension-screw, the natural frequency being thereby lowered so that no appreciable vibration occurs. On a crack appearing in the specimen, the natural frequency is reduced, and the auxiliary vibrator comes into action, vibrating with an amplitude sufficient to touch a fixed contact; this closes a local circuit and short circuits part of the resistance in the grid-filament circuit, causing the gas-filled relay to take an increased anode current, which trips a small circuit breaker. The unit is thus shut down, and the corresponding pen of the recorder is lifted up so that the record indicates the point at which the particular bar has failed.

The recording drum is driven by a synchronous motor, supplied from the oscillator that vibrates the lowest stressed bar. As the time of operation or the number of cycles endured varies over wide limits a logarithmic scale of cycles is necessary in order to cover the range, which for steel bars, may be taken as about 10^4 to 10^8 cycles.

The standard G.E.C. fatigue tester is destined for half-inch round steel bars of 18 inches length, for which the natural frequency is between 250 and 300 cycles per second; modifications of distance between centres, etc., are required for other dimensions. The apparatus may also be adapted to deal with non-uniform loads and the application of a fixed bending load or torsion at the same time as the vibrating stress.

A.F.A. Exchange Paper

MR. A. J. MURPHY, M.Sc., author of this year's Exchange Paper presented on behalf of the Institute of British Foundrymen to the Annual Conference of the American Foundrymen's Association, now being held in Toronto, has been chief metallurgist with Messrs. J. Stone & Company, Limited, of Deptford, London, S.E.14, from 1931. He graduated with first-class honours from the University of Manchester in 1920, and was appointed research assistant to Prof. C. A. Edwards at the University College, Swansea,

MR. A. J. MURPHY, M.Sc.

University of Wales. From 1923 until his present appointment he was scientific assistant in the Metallurgy Department, National Physical Laboratory, Teddington.

Mr. Murphy is the author and co-author of Papers on copper-aluminium-nickel alloys, copper-phosphorus, alloys of silver, amalgams, metallography at low temperatures, wrought iron, iron chains, cracking of boiler plate and bearing metals before the Royal Society, the Royal Microscopical Society, the Institute of Metals, and the Institution of Mechanical Engineers. He is a member of the Council of the London Branch of the Institute of British Foundrymen.

Nickel and Munitions

Mr. Robert C. Stanley, the President of the International Nickel Company of Canada, Limited, has sent the following letter to the shareholders. "Until the public at large realizes that there has been a significant change in the world nickel industry during the last fifteen years, we may continue to hear the repeated charge that your company is trafficking in a war material.

"The alloy age had its inception in the world war, and thus nickel, as a useful alloying element, became associated in the public mind with munitions. With the passing of years this alloy age has become linked with the progress which is being made in transportation, communication and industry at large, and nickel continues in its rôle as one of the most useful of the alloying elements. The result is that more nickel is currently going into the numerous fields of peacetime activities than ever went into the world's battlefields.

"Every person who has expended thought, energy or money in the development of nickel has cause for pride in the record which your company is making in a world at peace."

Works to be Visited during Belgian International Congress

The programme of the International Congress, which we printed in our issue of August 1, on page 84, is confirmed by the official one, which we have now received. From this document we have culled the following information relative to the works to be visited:—

Saturday, September 21, at 9 a.m.—The works of the National Radiator Company at Vilvorde or the Moll-Gompel Glass Works at Glaver (Owens process).

Tuesday, September 24, at 9 a.m.—The works of the S.A. Union des Aciéries at Marcinelle, near Charleroi (steel foundries).

Saturday, September 28.—John Cockerill & Company or Société Métallurgique d'Espérance Longdoz, or the Val St. Lambert glassworks, all in the Liége district.

The post-convention tour lasts three days—September 26 to September 28—and includes much sightseeing, with the visits to the works on the Saturday and a farewell dinner in Liége. This tour costs 450 Belgian francs, or about £3 15s. per person, everything included.

The Electric Furnace in the Non-Ferrous Foundry

By A. G. ROBIETTE, B.Sc.*

The application of electric melting in the non-ferrous foundry has not made, in this country, the headway that it has abroad, and has even lagged behind corresponding developments in the cast-iron and steel foundry. The reasons are difficult to seek, but many of the seeming drawbacks can now be shown to be non-existent in the light of experience gained in other countries. The majority of non-ferrous foundries in this country have a small irregular output of a variety of mixes. This does not favour the adoption of certain types of electric furnace which are mainly restricted for use in connection with the large non-ferrous rolling mill.

The indirect arc type of furnace which has literally invaded the non-ferrous foundries of America to the extent of over 500 installations does not seem to have been seriously considered in this country, for reasons which are difficult to elucidate. It is often erroneously thought that one of the reasons for this widespread use of electric melting in the American foundry is cheaper power. On the contrary, the average cost of power in the U.S.A. is 25 to 50 per cent. more than in industrial localities in this country. The fact that the electric furnace eliminates much of the arduous and heavy labour identified with fuel-fired melting and casting methods, allied with the fact that labour costs are higher in America, may in some small measure be one reason for this situation. In America the foundries on the whole are larger than those in this country, which may be a further contributory factor in their electrification. The two facts cited above form, however, no justifiable explanation for the apparent apathy of British foundries to the introduction of the electric furnace.

* Chief Metallurgist, Messrs. Birmingham Electric Furnaces, Limited.

Foundry Requirements

In the first instance, questions affecting the founding of copper rich alloys will be considered. The needs and problems encountered in the brass foundry differ somewhat from those met with in the aluminium foundry, so that this latter subject will not be dealt with in this article.

Rapidity of melting is one of the main desiderata in the foundry. It entails a small amount of floor space for a given output of metal, while at the same time it ensures a supply of molten metal at short regular intervals to the moulding floor—saving space again in this direction. A short melting time also enables a variety of mixtures to be poured within a limited period, which is often a problem to be faced with large, slow-melting furnaces. The more rapid the melting, the greater is the overall efficiency for two ostensible reasons: the melting chamber is smaller with a decreased area for thermal losses, and the time over which these losses occur is shorter. Oxidation is also minimised, even if this could occur, whilst for the same reason the absorption of gases would be reduced if conditions were such that soluble gases were present.

In order to obviate the necessity for duplicating melting plant, a further requirement is flexibility in relation to the range of materials which can be dealt with in a single furnace. The founder often wants to cast several alloys varying slightly or radically in composition without fear of serious contamination of the melt with metals from the previous charge. If cleaning or scouring of the furnace is required this should be capable of being done expeditiously.

The metals which are being handled in brass and bronze foundries are of relatively high intrinsic value, as compared with cast iron and common steels, which increases the importance of eliminating metallic losses during melting. This can only be ensured by operating with a neutral or reducing atmosphere, and, in the case of volatile constituents such as zinc and lead, by careful control of temperature. In a large proportion of non-ferrous foundries especially those attached to machine shops a considerable quantity of light scrap such as swarf and turnings is produced and it becomes essential to be able to reclaim this without excessive melting loss or alteration in composition. The ability of a melting plant to utilise this material and, if possible, to produce castings directly, without previously casting into ingots or pigs, is a very definite asset.

In times such as we have experienced, now happily passed, intermittent working was often

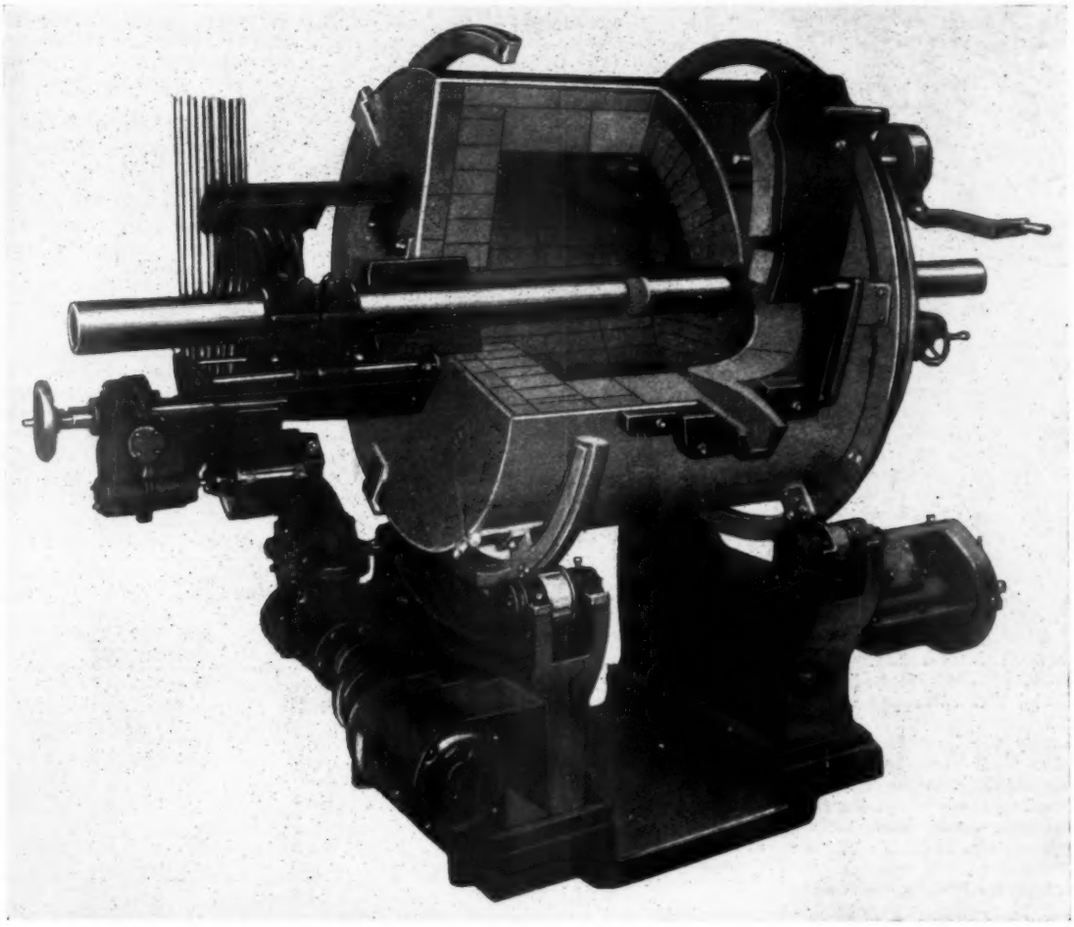


FIG. 1.—THE DETROIT ROCKING FURNACE.

a necessity not imposed by choice, which made it imperative for the foundryman to install plant which was capable of being operated, for only a few charges per day, at a cost which would not be prohibitive in relation to the product being sold. This in effect calls for a furnace with a comparatively low thermal capacity and a moderately high input of energy. These two factors ensure rapid heating from cold as well as a fairly low expenditure of energy for the initial heating.

Temperature regulation has been emphasised previously in relation to its effect upon the loss

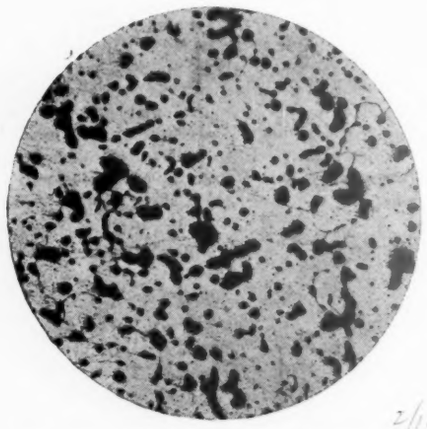


Fig. 2.—Bearer Liner, showing Uniform Distribution of Lead. × 100.

of volatile constituents. It is equally important from the point of view of control of pouring temperature which can have a vital effect upon the metallographic structure and physical properties of the resulting casting. Of no less importance is its influence upon the rate of solution of gases, chiefly hydrogen and sulphur dioxide in the case of copper-rich alloys. The input of heat must also be under the ready control of the operator who should be able to raise and lower the temperature at will.

Lining life and the ease or otherwise of renewal must also be considered. Often alloys containing lead, aluminium, zinc and tin have to be melted in one furnace shell and if contamination of a subsequent melt is to be avoided a simple fluxing treatment is essential, in certain cases. The lining must be capable of resisting the action of these fluxes as well as a certain amount of dross formed during melting and sand and dirt entrapped with the charge.

The last but hardly the least factor of importance is that the plant must be rugged in design and capable of withstanding the rough usage common in casting shops whilst the handling of the equipment should lend itself to operation by comparatively unskilled labour.

Electric Brass Melting

The numerous types and variation of types of electric furnace which have been devised and tried for the melting of copper-rich alloys, especially the brasses, are legion. A comprehensive review of most of the development work done in this direction has been recorded by Gillett and Mack.* They examined almost every type of arc, induction, and resistance furnace in existence at that time and out of this mass of accumulated knowledge there emerged only two types of melting furnace which have since survived the tests of time in the brass foundry. One was the vertical channel induction furnace so widely used in the large rolling and extrusion mill and the other was the rocking indirect arc furnace which has almost become identified with electric brass foundry practice. The induction furnace has been used to a limited extent in the large brass foundry pouring large quantities of repetition castings whilst on the other hand, the rocking arc furnace has found an application in the small rolling mill where flexibility in regard to variety of mixes is the deciding factor. Both types of furnace can produce metal of surpassing quality, with a comparatively low melting cost and a low loss of volatile alloys. The respective utility of both types of furnace may be gained from the following rough estimates of the proportion of installations in the foundry and in the wrought brass industry.

	Foundry. Per cent.	Rolling and extrusion mill. Per cent.
Induction furnace ..	20	80
Rocking arc furnace ..	80	20

It should be stated that there is very little to choose between the total number of installations built of each respective type.

There are not, in this country, many foundries capable of running for a considerable period continuously on one or two types of alloy, which makes it difficult to justify an induction furnace of the vertical channel type except in a few isolated cases. For this reason only the operation and application of the rocking arc furnace will be dealt with here.

Description of Rocking Arc Furnace

This type of furnace, better known as the Detroit rocking arc furnace, is not a new development, although its introduction in this country is comparatively recent. It was originated by Gillett and Rhoads at the U.S. Bureau of Mines some eighteen years ago, at first for the melting of zinc and lead containing alloys, but has since been applied to the melting of practically all copper-rich alloys, nickel alloys, cast irons and other ferrous alloys.

It is a familiar barrel-shaped furnace lined with special refractory material and having on its horizontal axis two graphite electrodes projecting through the ends of the drum. These electrodes cause an arc to be struck in the middle of the furnace above the solid or molten metal. The furnace is mounted on rollers, and is mechanically and automatically rocked through a varying angle, depending upon the condition of the charge. The angle of rock is small at first when the charge is still solid, and is continually increased until, when the "all molten" stage is reached, the angle is between 180 and 210 deg. The rate of movement of the shell is of the order of two complete cycles per minute. Fig. 1 is a cut-away section of the furnace showing most of the principal features.

The heat is transferred to the metal by radiation and by contact with the heated refractory walls, which are also receiving radiation. The rocking motion thus serves to accelerate heat transfer and to ensure that the refractory is kept at a comparatively low temperature. Moreover, the motion of the charge serves to present new surfaces to the radiation of the arc, and as soon as some of the metal starts to melt this will continually submerge unmelted particles.

Access to the interior of the furnace for charging is made by a single door, at the bottom of which is a spout for pouring. This latter can be plugged up during melting with a plastic refractory, making the furnace comparatively gas-tight except for the sliding clearance at the electrode ports. The furnace is fed from a step-down transformer, the secondary of which gives the required voltage for the arc. To ensure arc stability a variable reactance is incorporated in the transformer circuit. The input of energy is controlled as in other arc furnaces by varying the gap between the electrodes. Separating the electrodes decreases the power, and conversely. On small and medium sizes of furnace automatic control is often not justified, and the arc only requires occasional adjustment on the hand wheel to compensate for the consumption of carbon. On the other hand, where a battery of furnaces are installed and where one man is in charge of two or more furnaces, the additional cost of automatic control is often commensurate with the savings to be gained. It should be noted that the arc formed during melting is extremely steady, due to the prevalence of metallic vapour in the arc, and should not be compared with a direct arc employing vertical electrodes, where the metal intercepts the path of the arc.

The input of energy is comparatively high in relation to the holding capacity of the furnace, with the result that melting is extremely rapid, probably more rapid than in any other type of fuel-fired or electric furnace yet devised. Table I gives the kilowatt rating, holding capacity, and the productive capacity for various sizes of furnace.

It will be noted that the holding capacity of the furnace is less for solid than for molten metal, due to the inevitable volume of voids and the necessity for charging below the level of the electrodes in the case of heavy scrap. The object of quoting molten-metal capacities is because advantage is often taken of this fact, and subsequent feeds made up to the full molten complement if larger ingots or castings are required. It is also necessary to know the molten capacity in the case of furnaces used for duplexing. The figures given for cold-charging capacity are only arbitrary, and will depend upon the type of charge and method of loading. Loose swarf may be inserted above the electrodes, but is generally found necessary to make the subsequent feeds if all swarf charges are being melted. The melting time may be deduced from the above table. For copper alloys it is generally between 20 to 25 min. per charge.

Table I.—*Normal Performance of Detroit Furnaces.*

Transformer rating, kw.	Cold metal-holding capacity in lbs.		Molten metal-holding capacity in lbs.		Productive melting capacity in lbs. per hr.	
(1)	Brass (2)	Iron (3)	Brass (4)	Iron (5)	Brass (6)	Iron (7)
25	35	35	80	80	100	50
75	200	—	325	—	500	—
100	—	200	—	325	—	250
100	350	—	500	—	600	—
125	350	350	500	500	700	350
150	500	—	1,250	—	1,000	—
175	—	500	—	1,250	—	500
250	800—1,000	—	2,000—2,500	—	1,500	—
400	—	1,000	—	2,500	—	1,000
350	3,000	—	7,000	—	2,000	—
600	—	3,000	—	7,000	—	2,000

Mixing Action of Furnace

The purpose of rocking in its effect upon heat distribution and rate of heat absorption have been emphasised. Its importance from a metallurgical view-point is none the less marked. It ensures complete uniformity of composition throughout the melt, which assists in obtaining homogeneity in the resulting ingot or casting.

* U.S. Bureau of Mines, Bulletin No. 202.

Often solid and somewhat infusible additions have to be made in the foundry, and it is only by rapid mixing of the melt that their ready assimilation can be assured. Lead is a common addition in copper-rich alloys. In small proportions it gives free-machining properties. Large additions of lead are made to confer the properties required of a bearing metal. Both these examples are met with in foundry practice. Lead has only a very limited solubility in molten copper alloys, and is commonly present in the solid metal as globules. The size and distribution of these particles affect considerably the resulting properties. Segregates are therefore to be avoided, and it is desirable that the particles are finely divided.

DAILY OPERATION

DETROIT ROCKING ELECTRIC FURNACE

FURNACE NO. 1 OPERATOR 30 PLANT DATE

Day Heat No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Lining Heat No.	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830			
Time Start Charging		7:15	7:57	8:33	9:04	9:35	10:36	10:37	11:08	11:38	12:08	12:39	1:10	1:42	2:13	2:44	3:15			
Time Arc On	6:30	7:22	8:00	8:36	9:07	9:38	10:09	10:40	11:11	11:40	12:11	12:42	1:14	1:44	2:16	2:47	3:18			
Time Arc Off																				
Kw. Hr. Start Reck																				
Kw. Hrs. Robent																				
Total Kw. Hrs.	90	70	60	59	58	58	57	57	57	57	57	57	57	57	57	57	57			
Total Temperature °F	2230	2240	2240	2240	2240	2240	2250	2240	2250	2250	2250	2250	2250	2250	2250	2250	2250			
Weight of Charge	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425	425			
Composition and Analysis of Charge																				
DELAYS Minutes																				
DELAYS Cause																				

FIG. 3.—FURNACE DATA SHEET WHEN MELTING RED BRASS FOR VALVE CASTINGS.

A photomicrograph of a bearing liner cast from a rocking arc furnace is shown in Fig. 2, which illustrates the uniform distribution of lead. Several samples have been taken of the lead content of alloy from the first and last pourings of a charge, and the variation rarely exceeds 1 per cent. of the lead content, i.e., if the lead from the first shank was 12.5 per cent., the last metal poured would not exceed 12.65 per cent.

Temperature Control

There has not yet been any appliance introduced into the foundry which will give the melter automatic control of temperature (except resistor heated furnaces for low temperature work). The rocking arc furnace will give, without reference to a thermocouple, under regularised production, the pouring temperature accurately to within 20 degrees C. For a standard weight of charge of a certain alloy, assuming the furnace is in a state of temperature equilibrium throughout the refractory, the thermal requirements are fixed. The heat losses from the external shell are constant at a constant temperature and the heat required to raise the metal to a certain temperature is an absolute quantity. It therefore follows that the same number of units of energy will give the same pouring temperature. The control panel, for this purpose, is fitted with a dial type integrating kilowatt-hour meter and all the melter has to do is to pour it when the "clock" indicates the required number of units consumed. This may seem a rather far-fetched deduction from purely theoretical reasoning but it is a fact that most foundries actually rely upon this method rather than pyrometer determinations. The data sheet, Fig. 3, is selected at random from a series of records. It shows that once the furnace is soaked through (after the first three or four heats) the same number of units of electricity dissipated in the furnace will give the same pouring temperature. The low thermal capacity of the furnace is illustrated by the rapid heating from cold in the morning. The initial preheating as well as the melting of the first charge only occupies 45 minutes. It will also be seen that the approximate amount of energy absorbed by the linings is only of the order of 37 k.w.h. over and above the daily requirements of 1,022 k.w.h. A further feature is that the melting time with the same weight of charge is consistently the same.

DAILY OPERATION

DETROIT ROCKING ELECTRIC FURNACE

FURNACE NO. 4 OPERATOR PLANT DATE

Day Heat No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Lining Heat No.	4194	95	96	97	98	99	4200	1	2	3	4	5	6	7	8	9	4210		
Time Start Charging		7:06	7:45	8:18	8:56	9:38	10:20	10:52	11:26	11:59	12:35	1:06	1:41	2:20	2:51	3:40	4:15		
Time Arc On	6:10	7:10	7:49	8:22	9:09	9:47	10:25	10:56	11:35	12:05	12:39	1:10	1:45	2:26	3:04	3:45	4:20		
Time Arc Off	6:56	7:42	8:15	8:55	9:35	10:15	10:50	11:23	11:58	12:32	1:03	1:40	2:12	2:54	3:34	4:15	4:48		
Kw. Hr. Start Reck																			
Kw. Hrs. Robent																			
Total Kw. Hrs.	55	57	55	55	55	55	55	55	55	55	55	55	55	55	55	55	*55		
Total Temperature °F																			
Weight of Charge	401	401	401	401	401	401	401	401	401	401	401	401	401	401	401	401	401		
Composition and Analysis of Charge 82% Copper 4% Tin 9% Lead 5% Zinc	No. 82 Metal	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82	82		
DELAYS Minutes																			
DELAYS Cause																			

FIG. 4.—FURNACE DATA SHEET FROM A SECOND FOUNDRY.*

Fig. 4 is included as a matter of interest. This is taken from the records of a different foundry also working on the kilowatt-hour meter as a temperature indicator. In this case the composition of the alloy is given.

Another factor of importance in temperature control is the thermal storage of the refractory above the temperature of the molten metal. In many fuel-fired furnaces especially the crucible type there is a marked tendency for the temperature to rise immediately the source of energy is removed. This is due to the fact that a large amount of heat is stored in the crucible or furnace walls and is given up to the metal if the refractory is at a temperature above that of the molten metal. The fact that the rocking arc type of furnace is internally heated and the refractory is continuously washed by the molten metal practically eliminates this defect.

(To be Concluded.)

* Includes 10 kw.-hrs. for melting glass and slagging out furnace hearth and glazing lining.

Publication Received

Graphical Studies of Tin Alloys.—"Equilibrium Diagrams of Binary Alloys of Tin" by ERNEST S. HEDGES, D.Sc., M.Sc., Ph.D., A.I.C., and C.E. Homer, B.Sc., Ph.D., is the subject of Technical Publication, Series B, Number 2, of the International Tin Research and Development Council.

This book contains 67 diagrams relating to the binary alloys of tin, with no less than 34 of the elements. To the research worker they are useful because they indicate which groups of alloys are likely to be capable of improvement and development. The practical man who is concerned with the preparation of alloys containing tin for specific purposes will find the diagrams a valuable guide to the attainment of the properties he desires his alloys to have.

The constitution of binary alloys and the interpretation of equilibrium diagrams have been clearly and concisely explained in the introduction to this work, and increase the value of the book for those who have not previously studied the subject academically.

The data have been taken from the original literature. The diagrams are arranged alphabetically according to the name of the element alloyed with tin. Beneath each diagram is a table containing data regarding the temperatures of the various transformations and the ranges of composition, expressed in percentages by weight of the alloys in which they occur. The book should prove of value as a work of reference to the practical man as well as to the research investigator.

Copies of the above Paper may be obtained free of charge from the International Tin Research and Development Council, Manfield House, 378, Strand, London, W.C.2.

Catalogue Received

Down-Draft-Preventing Pots. A good deal of personal interest was aroused by the receipt of a catalogue from Messrs. J. H. Sankey & Son, Limited, of Ilford, Essex, because the reviewer has been considerably annoyed through a smoky chimney. As he failed to effect a cure by mechanical means, he changed over to a smokeless fuel. Probably he has substituted CO and CO_2, but has noticed no ill-effects. The registered design with which this brochure deals has not been tried by the reviewer, but from the number of testimonials reproduced it is clear that a solution has been found. Foundrymen placed in a similar position should certainly procure this catalogue, which has been made available for them.

"Castings."—We sincerely regret that Mr. J. G. Pearce's written remarks on the Paper on "Castings" by Messrs. Machin & Oldham were included in the discussion of the Paper of Dr. Swinden and Mr. Bolsover on "Ingot Moulds" on page 124 of our last issue.

Foundry Selling Practice

THE USE OF BROADSIDES

By ERIC N. SIMONS

In a previous article reference was made as to the necessity of enclosing literature with the sales letters sent out. It is most important that the literature in question should be specifically designed for the purpose, and aim at creating a particular effect. In the carrying out of this, few forms of publicity literature are more effective than what is technically known as the "broadside," or "folder." It is usually about 10 or 11 in. by 8½ in., or thereabouts, when folded, but it opens out to a large broadside sheet, measuring anything from 20 to 22 in. by 17 in. The advantage of this type of pamphlet is the opportunity it gives for effective display, and for the employment of large and impressive illustrations. The folds can also be varied ingeniously. Thus, they can be straightforward, as in Fig. 1, or a little more intricate, as in Fig. 2. Once the notion of this variation has been grasped, there is no limit to the number of tricky things that can be done in the way of ingenious folding. The one thing that must be borne in mind, however, is that the front sheet should never be less than 10 by 8½ in., as on the appearance of this depends a great deal of the effect.

It should also be remembered that the object of folding is not merely to be clever, but to bring out more clearly or arrestingly certain points in the sales talk the folder contains. To introduce folds unnecessarily is to annoy and confuse the reader. Furthermore, special folds have to be paid for, as the printer has to make unusual arrangements of his folding machinery or has to do the work by hand because of its unsuitability for his machines.

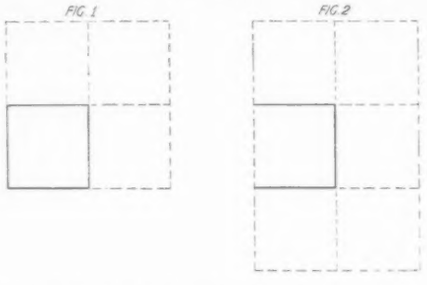
Now the object of these broadsides is to create an *instantaneous* impression. They are not meant to be kept for reference on shelves or in dusty drawers, though they often are. They are primarily designed to accompany a good sales letter, and to be attractive and suggestive enough to make the reader of the letter feel sufficiently interested to open them out to their full extent. Then, if some intelligence has been put into their preparation, they should, by virtue of their arresting quality, their freedom from hot air and padding, their eye-drawing illustrations, and the pleasing general effect they will create if artistically designed, retain the reader's eye until he has, willy nilly, absorbed a great deal more of the messages they contain than he intended to do when he first opened them out.

The mechanics of these folders are simple. They must not be more when folded down than 10 by 8½ in., because that is roughly the size at which they will go easily into a standard-sized catalogue envelope. They must not have too many folds, or there will be ugly lines of fold cutting across the illustrations and the text in awkward places. They must not look stodgy or dull on the front, or the reader will not trouble to open them out. And the blocks, the colour scheme, the types and display matter, must all be free from any suggestion of makeshift or cheapness.

A vital matter is the writing of the text for these pamphlets. The need of making the headlines crisp and compelling has already been stressed; it is, however, equally important that the paragraphs they head shall be concise and to the point. Every paragraph should have its one specific purpose. Thus, in a pin-and-bush folder, for which the author was responsible, one paragraph gave the result of tests on manganese steel pins; another described a characteristic performance; a third dealt with the subject of forged or cast bushes. Every paragraph had its own particular part in the general scheme. Similarly, in a stainless-steel castings broadside, the text dealt with the weight of casting that could be made, the stainless materials that could be supplied, the uses for which these castings could be employed, and so forth.

Because the broadside must be so specific in its appeal, it is better to have separate broadsides for particular classes than to attempt to include every type of casting in the one sheet. The same foundry that published the broadside on stainless castings had, for example, similar broadsides on manganese-steel castings, chrome-steel castings, and ordinary steel castings. When an attempt is made to get every type of casting into the one sheet, the force of the appeal is partly lost, because it is almost certain that the recipient will not be interested in *every* type, and there is always the possibility that his eye will fall first on those in which he is not interested, and cause him to reject further investigation of the broadside's contents.

It should be borne in mind that the work of the broadside is not completed when the reader



has looked at it and gathered its message. Both it and the sales letter it accompanies should seek to promote action by the customer. Therefore, a request form should, wherever possible without harming the effectiveness of the design, be incorporated in the broadside. This request form should be for literature dealing more in detail with the folder's subject. If it is desired to get the customer to ask for prices or the visit of a representative, it is better to include a separate reply postcard (preferably a business-reply card) with the letter, which the customer can fill up and post if he feels inclined.

Two-Colour Printing

The use of a second colour is always desirable, but this need not be extraordinarily expensive. In one case, the cover was carried out wholly by line blocks (much cheaper than half-tones), printing on a silver-coated paper, thus giving the effect of three colours. Restraint should, however, be exercised in the use of the second colour, and it should not invariably be red. Red is a bold and striking colour, very effective when properly employed, but too much of it creates a harsh, ugly effect, and it has the power of producing this effect much more readily than, say, blue.

Glasgow Works' Diamond Jubilee

The Diamond Jubilee of the Eclipse Steelworks, Glasgow, of Messrs. Fredk. Braby & Company, Limited, is reached this year. After the late Mr. Fredk. Braby had established works at London, Deptford and Liverpool, he went to Glasgow 60 years ago and founded the Eclipse Works, which to-day give employment to 1,400 workers in ten separate departments each producing different classes of steel products. During these years the company has not passed a dividend.

Application of Ferrous Castings to Chemical Plant

At the meeting of the Dechema (Deutsche Gesellschaft für Chemische Apparatewesen E.V.) held at Königsberg on July 3, 4 and 5, DR. H. JUNGBLUTH read a Paper dealing with the use of ferrous castings in the manufacture of chemical plant, pointing out that four distinct types of castings were used for this purpose. The first type had a silicon basis and comprised an alloy containing from 14 to 16 per cent. of silicon, including products bearing the trade names of "Thermisilid," "Tantiron," "Wegucit," "Sisteisen," and "Duriron," etc. The physical and mechanical properties of these materials were not exceptional, the transverse strength, for instance, being of the order of 10 to 20 kg. per sq. mm. with a Brinell hardness of about 300. The absence of unusual mechanical properties was, however, offset by the marked resistance to chemical attack in the presence of a large number of reactive and corrosive chemical bodies, and by the relative cheapness of these alloys and their excellent casting properties.

More favourable mechanical properties were possessed by alloys of the iron-chromium type containing from 13 to 15 per cent. of chromium, which could be differentiated into a cast-steel class and a cast-iron class. But the corrosion-resistant alloys of the cast-steel type with a pure chromium basis had not been able to make any headway against the nickel-chrome alloys, pointed out the author, while the high-carbon alloys, containing from 1 to 2 per cent. carbon and 34 to 35 per cent. chromium had also failed to make much progress. More important alloys were those on a chrome-nickel basis, where again a distinction was drawn between those resembling cast steel and those resembling cast iron. The former type included alloys on an 18 per cent. chromium basis, those with varying carbon contents and small percentages of chromium (martensitic steels), those with a low-carbon content, 8 per cent. nickel and 18 per cent. chromium (austenitic steels), while the second type comprised a material made up of about 1.5 per cent. carbon, 6 per cent. nickel and 25 per cent. chromium with an austenitic-ferritic ground substance and carbide inclusions.

In addition to the ferro-alloys, referred to above, a series of alloys had been evolved in the United States, especially for casting purposes, on the iron-nickel-copper basis, the first alloy being prepared by mixing 2 parts of grey cast iron with 1 part of Monel metal. The products were given the name of "Nimol" cast iron. In the meantime, these had been improved to give the "Niresist" irons, mainly by adding more alloy elements. The current limits of composition were C, 2 to 4 per cent.; Ni, 5 to 35 per cent.; Cr, 2 to 8 per cent.; Cu, 2.2 to 16 per cent.; Mn, 3 to 10 per cent., and Al, 3 per cent., the chromium in all cases being less than the nickel. These materials were excellent for casting purposes and had a much greater acid resistance than the bronzes which they had replaced for many applications.

Iron Trades Employers' Insurance

The directors of the Iron Trades Employers' Insurance Association, Limited, announce the appointment of Mr. W. C. Stansfield, for many years the company's district manager for Yorkshire, to the position of deputy-assistant secretary at head office. Consequent upon this appointment, the Leeds and Sheffield offices will, in future, be managed independently, and Mr. H. C. Rose, assistant manager at the Leeds branch, has been appointed branch manager at Leeds, and Mr. J. L. Hilton, assistant manager at the Sheffield branch, has been appointed branch manager at Sheffield, in succession to Mr. Stansfield.

Castings

By W. MACHIN and M. C. OLDHAM

(*Continued from page* 117.)

Feeding Iron and Non-Ferrous Castings

In the running and feeding of iron and non-ferrous castings, particularly the former, difficulties are somewhat modified, mainly on account of there being less contraction. In addition, more extended freezing ranges and lower casting temperatures assist the foundryman considerably. It must not be inferred that troubles are never experienced in these alloys, but happily they are not so formidable as those connected with the manufacture of steel castings. Some illustrations of iron castings (Figs. 19 to 23) will indicate that the methods adopted are free from much of that additional work inseparable from the manufacture of moulds for steel castings.

The core for the casting in Fig. 21 was placed in the bottom print of the mould, the reverse position for a similar casting in steel. Fig. 22 would have been made in the bottom half of the mould had it been in steel, in order to facilitate feeding.

Spray runners around the top and bottom flange have given perfect results. These runners can be arranged from two, three or four down pegs over channels cut all around the joints. The sprays from these channels into the flanges are of equal size, and spaced equidistant to ensure even cooling. Feeders can be arranged from the side of the top flange opposite, that is, in between the runners or sprays, but they must all be of the same dimensions and equally spaced. Various kinds of feeders are shown in Fig. 24, all having been recommended by different founders.

Feeder A is of the same thickness as the casting and should cool at approximately the same rate. In this case the extra metal cannot be effective should any feed be required for the casting, its only service being to catch any dirt rising to the top of the mould.

Feeder B is larger in bulk, but it will be noticed that the centre of the head is placed so as to feed directly on to the radius at the back of the flange. The remarks regarding feeder B apply also to feeders C and D.

Feeder E shows a different design, tapered on both sides so that the centre of the feeder is directly over the part requiring feeding, viz., the cross section where the flange meets the vertical wall.

Of the numerous types of feeders, heads or risers seen or tried out over long personal experience, the best design appears to be that which places the centre of the feeder directly over the centre of the part to be fed. The need to stress this important point will be excused. It sometimes happens that local chilling is resorted to at those parts difficult to reach with feeders, but this method unless carefully dealt with will cause weaknesses, particularly in connection with some metals that are likely to become brittle by too quick cooling. Also, metallurgical changes take place under chilling methods, which in many instances are not desirable.

Each class of irons to some extent alters methods of production in respect to feeding and running, on account of alloy and steel additions, which cause increased shrinkage to occur in changing sections, even with very low-phosphorus content. Cast iron is now frequently subjected to quenching and tempering, and much advance also has been made recently in connection with alternative forms as a result of considerable attention by research workers. Much of the advance made in recent years as regards strength of cast iron without alloy additions has been chiefly due to a reduction in the graphite size, coupled with a reduction in the quantity present.

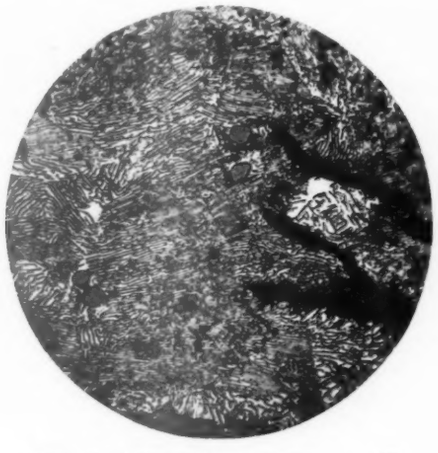


Fig. 26.—Perlit Iron Etched. × 400.

Fig. 30A.—Heat-Treated Iron. × 100.

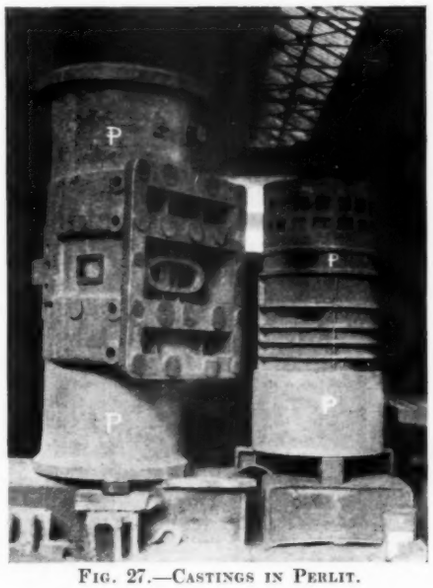


Fig. 27.—Castings in Perlit.

"Lanz Perlit" Process

The value of obtaining a small amount of graphite in a structurally-fine condition is obvious, as is the desirability of obtaining as high a combined-carbon content as possible in the pearlitic condition. Iron made by the well-known "Lanz Perlit" process is typical. This is obtained by casting into a hot mould iron of such low-silicon content, that it would normally give a white or mottled structure if cast in a mould which was just warm or cold. Moulds made for this class of casting need more careful handling than those for ordinary iron, and feeding methods require more attention.

Figs. 25 and 26 are micrographs of ordinary and Perlit iron, and in the etched condition, and illustrate the relative amounts of pearlite. Perlit iron, due to the nature of the process, gives a comparatively uniform hardness and structure across the varying sections of a casting, and strengths of 18 to 20 tons per sq. in. tensile may be regularly obtained, together with high resistance to shock.

In order to appreciate fully the great advantage obtained by uniformity of structure in the casting, it should be borne in mind that in castings made from ordinary iron, structures are irregular, the outside portion of the section being more tough than the inside owing to the chilling effect of the mould, whilst at the centre portion of the section, the iron is comparatively open and weak, with large graphite flakes predominating. It is evident, therefore, that ordinary castings having this variation in structure will not give good results in service where resistance to heat and shock is required.

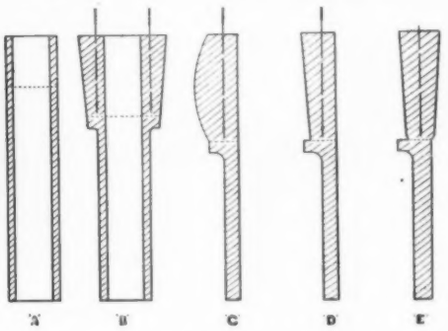


Fig. 24.—Various Types of Feeders used on Cast-Iron Liners and other Castings of a Cylindrical Type.

The Perlit-iron process produces a casting which will respond to high duties under elevated temperature conditions, and the contraction stresses are extremely low, due to the fact that the moulds are all heated prior to casting, with the result that the casting cools at a very slow rate. Repeated impact tests have been carried out, a 28 lbs. weight being allowed to drop a distance of 1 ft. on a sample 1½ in. sq. Samples of Perlit iron tested under these conditions have withstood as many as 382 blows, while samples of ordinary iron, similarly tested, fractured with a maximum of 12 blows. The greater shrinkage is a factor to be allowed for, and the heating of the mould to produce such conditions as will give the required structure necessitates increased attention being given to the moulding sand.

However, providing such conditions are well looked after, castings, such as those shown in Figs. 27, 28 and 29, are successfully manufactured, with analysis as follows:—Total carbon, 3.00; combined carbon, 0.80; and silicon, 0.80 per cent. The large casting to be seen on the left in Fig. 27 was over 5 tons in weight, and was cast at a mould temperature of approximately 320 deg. C. Other irons are made by various methods to produce an extremely-fine graphitic condition, with a corresponding increase in mechanical properties.

Another method already referred to for obtaining improved properties is to heat-treat the

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(*Continued from previous page.*)

Fig. 13.—The First Drawback in Position.

Fig. 14.—Assembly of Loose Pieces.

Fig. 17.—Another Type of Bottom-Half Cylinder Mould.

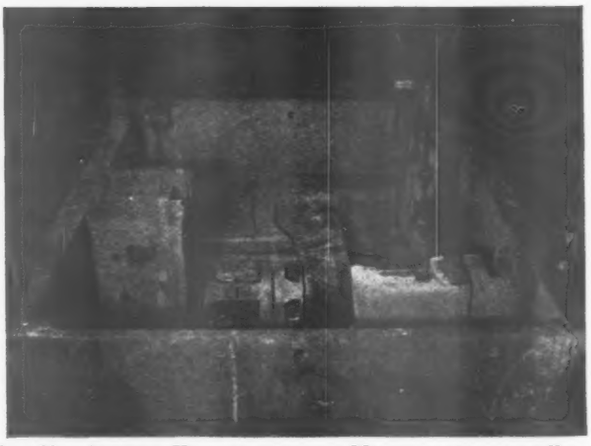


Fig. 18.—Another View of the same Mould showing the First Loose Pieces Inserted.

Fig. 21.—View of same Turbine Piece showing Cored Portion.

Fig. 22.—Bottom View of same Turbine Casting.

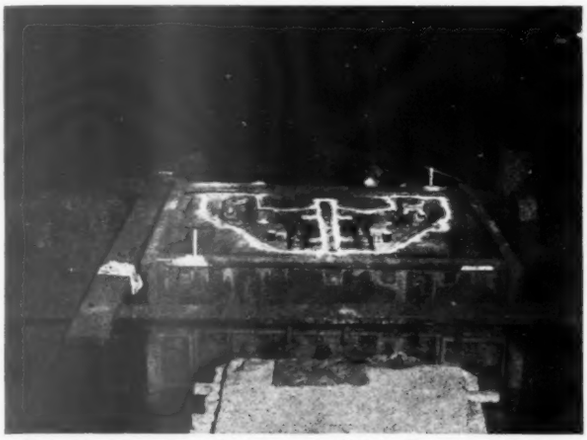


Fig. 15.—Complete Assembly of Loose Pieces in Bottom Half of Mould in readiness for placing Top Half in Position.

Fig. 16.—Feeders placed over Thick Sections in Assembled Bottom Half of Mould.

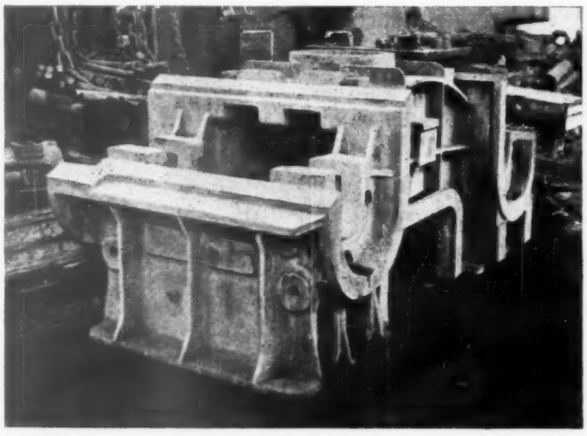


Fig. 19.—Top Half Cast-Iron Gear Case run at Bottom Flange as Cast.
(Shown in the casting position.)

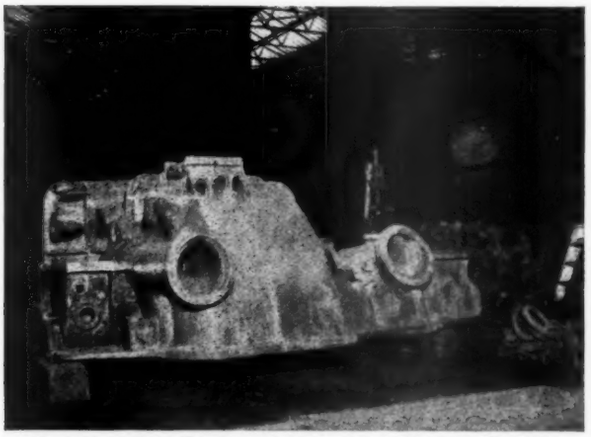


Fig. 20.—Half Turbine Casing run at Bottom Flange as Cast.
(Shown in the casting position.)

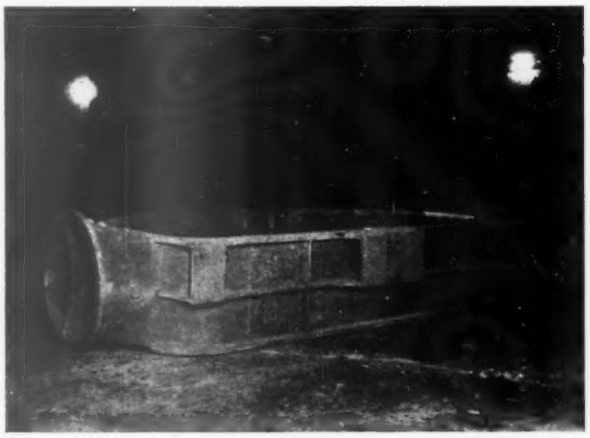


Fig. 23.—Condenser End Casting.
(Shown in casting position.)

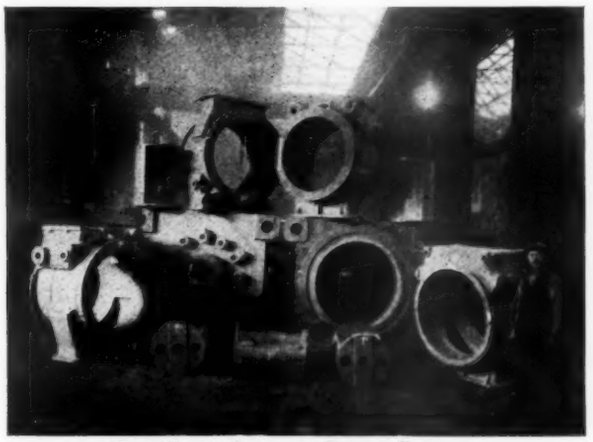


Fig. 28.—A Group of Perlit Castings.

XUM

metal, and very high mechanical results can be obtained by the process. To obtain the maximum benefit from the material in this form, however, it is necessary to have the combined carbon high, and the graphite should be fine, as coarse graphite materially reduces the value of the improved structure. The results of an investigation recently carried out by the authors on the effect of heat-treating Perlit iron made under the Lanz process are noteworthy.

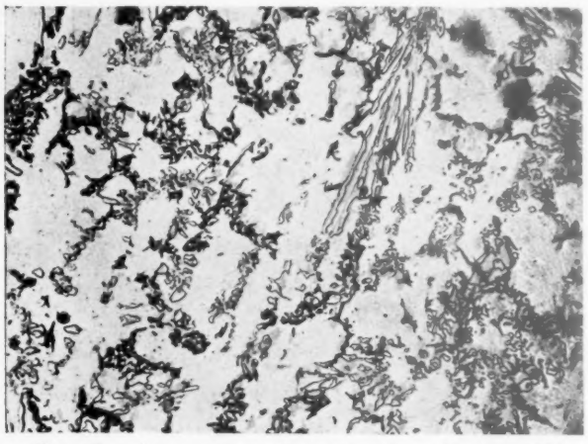


Fig. 31A.—Structure of Hard Nicrosilal Iron × 250.

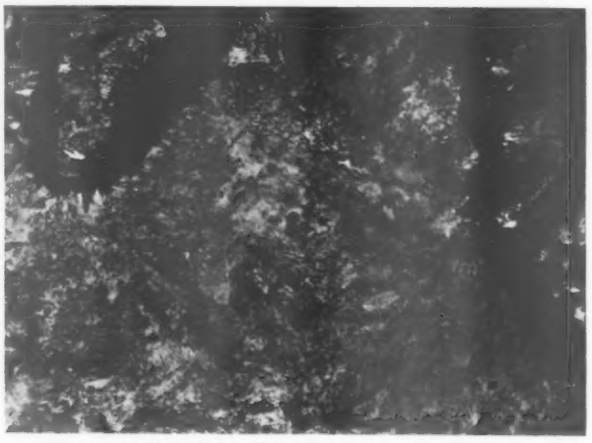


Fig. 30B.—Heat-Treated. × 750.

Fig. 25.—Ordinary Iron Etched. × 400.

For the purpose in question, actual castings were taken and cut up for test, so that the mass effect could be taken into account. The results obtained, therefore, indicate the actual strength of the castings, which were cylinder liners for a Diesel engine. The length of these castings was 38 in., the internal dia. 15 in., the section thickness 1¾ in. and the average composition was as follows:—T.C., 3.04; G.C., 2.34; C.C., 0.70; Mn, 0.73; Si, 0.76; S, 0.154; and P, 0.133 per cent. After being rough-machined, the castings were quenched in oil from 850 deg. C. and tempered at temperatures ranging from 450 to 650 deg. C. The most suitable tempering temperature was found to be from 500 to 600 deg. C. as shown in Table I. Had the combined carbon figure been nearer to the ideal of 0.80 to 0.85 per cent. still higher results would have been obtained. Micrographs of such iron are illustrated in Figs. 30A and 30B. Such results should assist designers and engineers considerably, especially where a material of high quality, with graphite present, is required.

Table I.—*Mechanical Properties of Heat-treated Perlit Iron.*

	U.T.S. Tons per sq. in.	Transverse test 1 in. sq., 12 in. cntr.			Brinell No.
		Tons.	Defn. in in.	Modulus of rupture. Tons per sq. in.	
Original iron	16.4	1.75	0.375	31.5	179
Quenched 850 deg. Tempered 500 deg.	26.8	2.75	0.28	49.6	303
Quenched 850 deg. Tempered 600 deg.	26.0	2.50	0.31	44.9	263

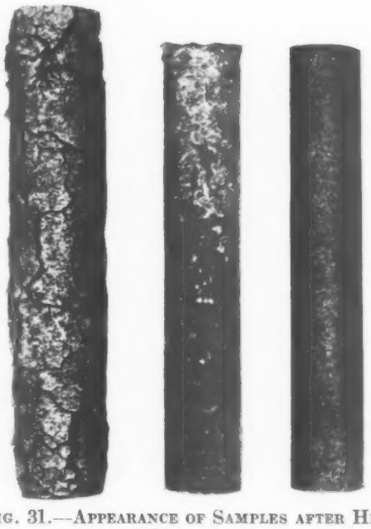


Fig. 31.—Appearance of Samples after Heat Testing.

Alloyed Cast Iron

Another well-known method of obtaining enhanced properties is by means of alloy addition, usually nickel and chromium. Such improvements, however, are noticeable, not so much from the point of view of high mechanical strength as from the greater equality of structure obtained across varying sections, giving greater uniformity and therefore more reliability in service. Much progress has also been made in relation to materials for specialised applications, such as

(*Continued on page* 140.)

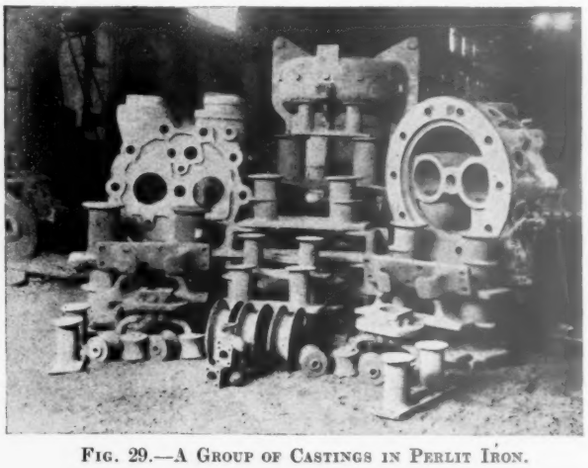
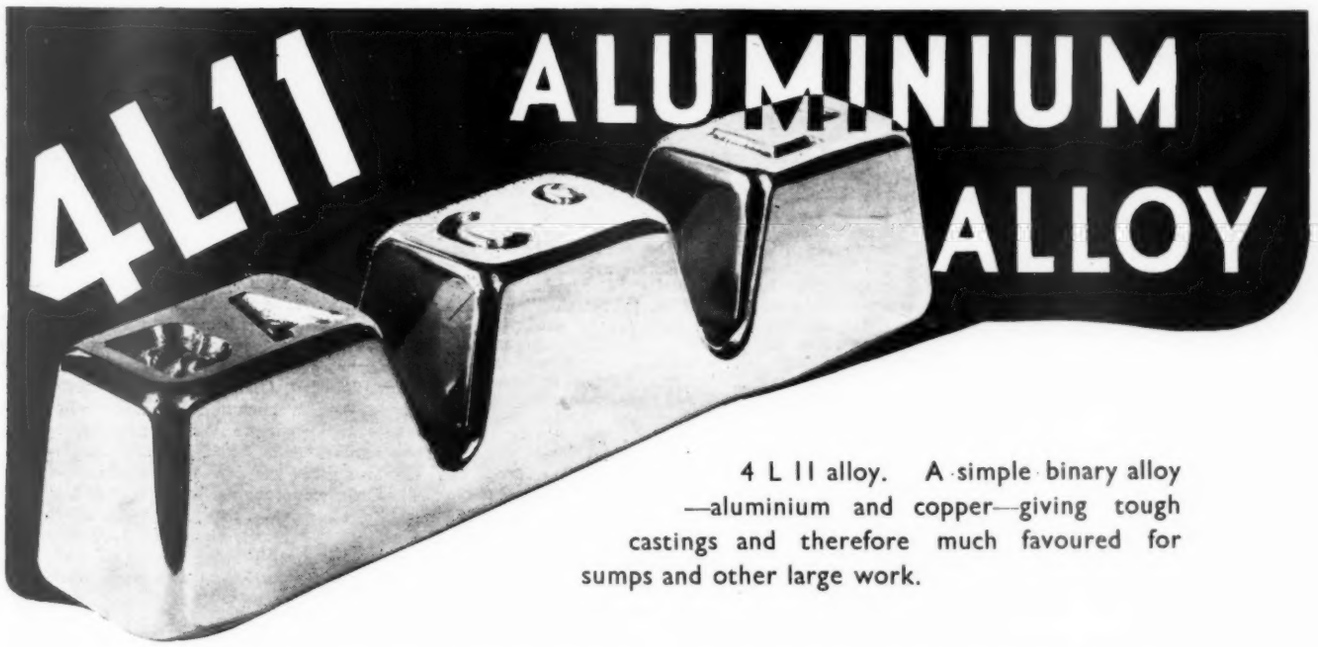


Fig. 29.—A Group of Castings in Perlit Iron.

Fig. 32.—Casting made in Nicrosilal.



4 L 11 alloy. A simple binary alloy —aluminium and copper—giving tough castings and therefore much favoured for sumps and other large work.

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F.T 1 22.8.35

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Pneumatic Rotary Grinders

This range of Rotary Grinders includes a size of tool specially suitable for your requirements:—Special features are:—

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3. High speed—reduced working time.
4. Simple yet robust construction—no time lost due to breakdowns.

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Sales Dept.: THAMES HOUSE, Westminster, London, S.W.1.

This Week's News in Brief

Trade Talk

A FIRE WHICH OCCURRED in the foundry at the Ebor Engineering Company, Ebor Street, Littleborough, Rochdale, recently, is believed to have been caused by a spark igniting a quantity of wood on the top of the drying stove.

MESSRS. BARCLAY, CURLE & COMPANY, LIMITED, Whiteinch, Glasgow, have secured an order to build a cargo steamer for Ellerman Lines, Limited. The vessel is to be 11,000 tons, and will be fitted with single-reduction geared turbines supplied by the builders.

THE CLYDE ALLOY STEEL COMPANY, LIMITED, Craigneuk, Motherwell, have just completed a new foundry building. A considerable amount of new plant is to be installed. The firm have recently opened very attractive-looking offices to the design of a London firm.

THE AEROGRAPH COMPANY, LIMITED, are making considerable extensions to their factory at Lower Sydenham, S.E.26. The new factory was only built by the Aerograph Company in 1930, but has already proved insufficient for present-day requirements, with the result that four extra bays are now being erected.

THE FOUNDRY & ENGINEERING COMPANY (WEST BROMWICH), LIMITED, have secured an order for two Acme patent vertical continuous drying stoves, of special design, to be erected in Milan. This order was secured against American and Continental competition, where continuous systems had already been inspected, and the designs actually decided on.

THE DEPARTMENT OF OVERSEAS TRADE announces that His Majesty's Government in the United Kingdom have been pleased to accept the invitation of the Organising Committee of the Exhibition in Johannesburg to participate in the "Empire Exhibition (South Africa), 1936," to be held in Johannesburg from September, 1936, to January, 1937.

MEMBERS OF THE Manchester Association of Engineers are visiting the works of the Renold & Coventry Chain Company, Limited, Burnage, on Saturday, September 21, 1935. Those intending to take part should write to the secretary, Manchester Association of Engineers, St. John Street Chambers, Deansgate, Manchester, 3, not later than Saturday, September 14, 1935.

IT IS REPORTED that Messrs. Haldin & Phillips, Limited, have placed an order for a motor vessel of 9,200 tons deadweight on behalf of the British United Steamship Company, Limited, with Messrs. Lithgows, Limited, of Port Glasgow. The propelling machinery will consist of Diesel engines of the Burmeister & Wein type, built by Messrs. John G. Kincaid & Company, Limited, Greenock.

ARRANGEMENTS ARE NOW being made for the next annual examination for admission to the probationer student and student class of membership of the Institute of Marine Engineers. The next examination will be held in June, 1936, at various centres according to candidates' places of residence. Full particulars of the syllabus and exemptions allowable may be obtained on application to the secretary, the Institute of Marine Engineers, The Minories, London, E.C.3.

AS THE RESULT of an alarming explosion, William Marshall, a furnaceman employed in the Larbert Brass Foundry, Larbert, Stirlingshire, had a part of one of his legs and one finger blown away. It appears that Marshall was engaged in breaking gunmetal scrap to a suitable size for melting, and, when he struck a cylinder, there was a violent explosion. The roof of the foundry had holes blown in it, and another worker was thrown some distance without suffering more than shock. It is presumed that the cylinder contained high explosive, and it was perhaps fortunate that the cylinder was too large to be put into the furnace whole.

CONSIDERABLE ALARM was caused in Falkirk in the early hours of Tuesday of last week, when it was discovered that smoke and flames were shooting from the roof of Burnbank Foundry. It was found to be due to the overheating of the tar-dipping tank and the setting alight of the tar. The blazing liquid ran over the sides of the tank and ignited some drums of naphtha. The fire brigade managed to subdue the outbreak and prevent it from spreading to the foundry buildings. No damage was done apart from the destruction of the tar and naphtha, and the work of the foundry was uninterrupted.

MESSRS. YARROW & COMPANY, LIMITED, Scotstoun, launched H.M.S. flotilla leader "Grenville" this week. She is to be the leader of the eight Class G destroyers of the 1933 Admiralty programme, and has a standard displacement of 1,460 tons and has a new arrangement of boiler room. In the past naval ships have been fitted with end-fired Yarrow-type boilers, but the "Grenville" will be fitted with the latest-type Yarrow boiler, side-fired, a system which effects considerable saving of space. Two hours after the "Grenville" had left the slip the keel of H.M.S. "Protector" was laid. This latter is to be employed in net-laying and target towing, and will be one of the largest ships ever laid down in Messrs. Yarrow's yard.

THE BRITISH CAST IRON RESEARCH ASSOCIATION has elected the following new members:—Ordinary members: David Brown & Sons, Limited, Huddersfield (representative, Mr. F. W. Rowe, B.Sc.); Darby & Company, Birmingham (representative, Mr. H. B. Darby); the New Conveyor Company, Smethwick (representative, Mr. W. R. Purvell); Non-Ferrous Die Castings, Limited, Cricklewood, London, N.W.2 (representative, Mr. N. D. G. Robertson). Trade members: Birmingham Electric Furnaces, Limited, Birmingham (representative, Mr. A. Glynne Lobley); Foundry Engineers, Limited, Halifax (representative, Mr. H. F. Coggon); the Ship Canal Sand Company, Weaste, Salford (representative, Mr. H. W. Cooper). Associate member: Mr. B. Commons, Leicester.

Personal

MR. T. C. GILCHRIST has recently been transferred from the St. Rollox Works of the L.M.S. Railway Company to their Crewe Works.

MR. J. G. PEARCE, director of the British Cast Iron Research Association, has been elected a member of the Council of the Staffordshire Iron and Steel Institute.

MR. ARCHIBALD BALLANTINE, foreman pattern-maker at Messrs. A. Ballantine & Sons, Limited, New Grange Foundry, Bo'ness, has just retired after more than 50 years' service with the firm. Mr. Ballantine has been a foreman for about 26 years and held in high esteem by all connected with the foundry. He has received a number of parting gifts from his fellow-employees and staff. Mr. Ballantine was noted for the interest which he took in the training and welfare of the young men who came under his supervision.

Obituary

MR. DAVID NUTTALL HARDMAN, a partner with his brother in the firm of R. Hardman & Bros., ironfounders, of Bacup, Lancashire, has died at the age of 51.

MR. KENNETH SUTHERLAND MURRAY, honorary governor of the British Oxygen Company, Limited, died at Geanies Fearn, Ross-shire, recently. Mr. Murray joined the British Oxygen Company in 1886. Last December, owing to advancing years, he resigned his position as chairman, managing director and director of the company. In view of his exceptional services to the company, the directors asked him to accept the honorary position of governor, in order still to retain his interest in the company, and to attend board meetings if he desired.

Contracts Open

Exmouth, August 25.—2,500 yds. of 4-in. dia. coated, sand-spun cast-iron pipes, for the Urban District Council. Mr. S. Hutton, engineer, Council Offices, Exmouth.

Hingham, September 5.—Seven miles of 3-in., 4-in. and 5-in. spun-iron pipes, for the Forehoe and Henstead Rural District Council. Mr. A. J. Martin, 106, St. George's Square, Westminster, S.W.1. (Fee £3 3s., returnable.)

Llangattock, September 6.—Provision and laying of 2,000 yds. of 3-in. dia. cast-iron pipe and 550 yds. of galvanised iron pipe, for the Crickhowell Rural District Council. Messrs. Thomas & Morgan & Partners, civil engineers, Pontypridd, Glam. (Fee £5 5s., returnable.)

Castings

(*Continued from page* 138.)

resistance to heat and corrosion. Regarding the former, ordinary cast iron fails at high temperatures as a result of rather complicated reaction.

In addition to surface oxidation, there are decomposition of the cementite present into ferrite and graphite, and expansion due to volume changes of the micro-constituents, and further oxidation along the fissures produced. Oxidation takes place to an increasing extent on ordinary iron with increased silicon content, but it was discovered that if the silicon content was taken well above the ordinary range, viz., from 6 to 7 per cent., very good heat-resistance properties were conferred. For temperatures up to about 850 deg. C. this material gives very good service and is known as "Silal." Lanz Perlit iron with low-silicon content also has very much less growth than ordinary engineering irons, and this iron gives excellent results when subjected to elevated temperatures. For higher-temperature service, however, austenitic iron such as Nicrosilal, gives almost complete resistance up to approximately 1,050 deg. C.

Table II gives the figures of some work recently done by the authors in this connection, giving the results of dimensional and weight changes after treatment of ordinary engineering iron, 6 per cent. silicon iron (Silal) and austenitic iron (Nicrosilal), after ten heatings to 950 deg. C. in an oxidising atmosphere, alternating with cooling down to atmospheric temperature. Nicrosilal contains 6 to 7 per cent. silicon, 18 per cent. nickel and 2 and 5 per cent. chromium respectively, in the soft and hard qualities. Fig. 31 shows the appearance of specimens after the test just described. The structure of this iron in the hard variety is shown in Fig. 31A.

TABLE II.—*Repeated Heat Tests to 950 deg. C. of Various Irons.*

Material.	Percentage change in	
	Volume.	Weight.
Ordinary iron	+70.1	+21.0
Silal	+ 4.5	+ 0.3
Nicrosilal (hard)	+ 0.4	− 0.3

The casting properties of these alloys are good, but contraction is more than that of ordinary cast iron, and therefore it is necessary to take special precautions during the manufacture of moulds, so that contraction is not retarded in any way, otherwise hot tears occur. A casting is shown in Fig. 32 made in soft Nicrosilal, this piece being 10 ft. long, 3 ft. 6 in. wide, ½ in. thick. It will be appreciated, therefore, that the metal is sufficiently fluid to cast complicated pieces.

(*To be continued.*)

Company Reports

Swan Hunter & Wigham Richardson, Limited.—Interim dividend of 3 per cent. on the preference shares for 1935.

Frederick Braby & Company, Limited.—Dividend of 7 per cent. on the ordinary shares for the year ended June 30.

New Company

(*From the Register compiled by Jordan & Sons, Limited, Company Registration Agents, 116 to 118, Chancery Lane, London, W.C.2.*)

W. H. Butler & Sons (Malleable), Limited, Cliffe Foundry, Dronfield, Derby.—Capital £2,500. Malleable ironfounders. Directors: W. H. Butler, F. V. Hall, J. Butler and H. Butler.

RIXON'S (W'BRO') No. 3 Foundry Iron

A fluid iron for light intricate castings

Builder's Hardware,
Brackets, Holloware,
Gas Stoves, Boilers,
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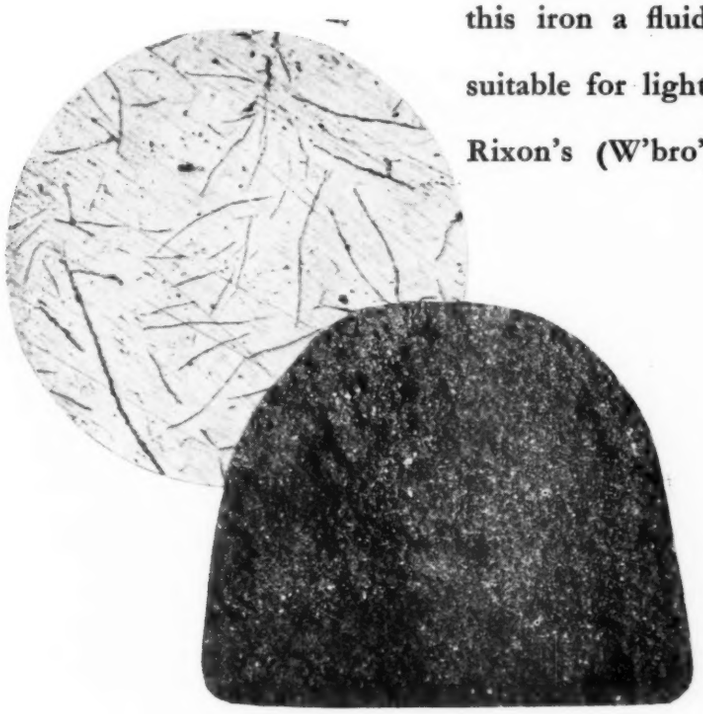
Rainwater and Soil Pipes,
Drainpipes, etc.

Recognized throughout the foundry industry as the leading brand of Northamptonshire iron, Rixon's (W'bro') No. 3 Foundry Pig Iron is produced in modern furnaces solely for the open market. Scientific furnace control enables the elements to be kept within close limits. The relatively high phosphorus content gives this iron a fluidity which makes it particularly suitable for light castings of all types.

Rixon's (W'bro') No. 3 Pig Iron is supplied in notched pigs, already broken in halves and therefore easily handled.



MICRO
50 DIAS:
UNETCHED

ANALYSIS

	Per Cent
Silicon	3.29
Sulphur	0.025
Phosphorus	1.65
Manganese	0.34
Graphitic Carbon	3.52
Combined Carbon	0.12
Total Carbon	3.64

THE STANTON IRONWORKS COMPANY LIMITED

NEAR NOTTINGHAM

The largest producers of Pig Iron (for Sale) in Great Britain

Raw Material Markets

Increased confidence in the iron and steel trade, following the arrangement with the Continental Steel Cartel, has resulted in a rise of iron and steel share values on the Stock Exchange. Holiday influences have again prevailed on the market and the fact that many consumers had already covered their requirements for some time ahead has tended to accentuate the quiet tone. However, a busy period is expected to commence after the end of August. Consumption of pig-iron is good, but the volume of new business is at a low level. Deliveries to works are large and consist of contracts arranged when rumours of an increase in price were prevalent. Hematite has few buyers for the same reason.

Pig-Iron

MIDDLESBROUGH.—Producers of pig-iron in this district are so well employed that there is every inducement to shorten or dispense with the annual holidays which are scheduled for this week. As a result of numerous local consumers' works being closed, pig-iron deliveries will be partially suspended. Owing to the shortage of iron the export trade is almost negligible, home demand being met in preference to foreign calls. The outlook for Cleveland ironmasters is very favourable, further expansion in the autumn being expected. The controlled prices to home consumers are at the following:—No. 3 Cleveland G.M.B., 67s. 6d., No. 1 foundry 70s., No. 4 foundry and No. 4 forge 66s. 6d., all delivered Middlesbrough.

The slacker period which has developed on the hematite market is looked upon as being a useful time to comply with old commitments. Large tonnages of hematite are being taken up by steel concerns in the home districts, but export trade, especially with Italy is at a standstill. The principal delivered prices of No. 1 East Coast hematite are:—Delivered Middlesbrough 71s., Tyneside 72s., North-East Coast 73s. 6d., Scotland 77s. 6d., Sheffield 78s. 6d. and Birmingham 84s. 6d.

LANCASHIRE.—Quiet conditions are expected to continue in this area for some time. Very little new contract buying of pig-iron has been reported during the past week, and most consumers are well covered up to the end of the year. Machine-tool manufacturers, light-casting founders, heavy electrical makers, and some speciality engineers have satisfactory prospects. Offers of Staffordshire, Derbyshire, and Lancashire brands of No. 3 foundry iron equal to Derbyshire are all on the basis of 74s. per ton for delivery in the Lancashire zone, with Northamptonshire at 72s. 6d., and Scottish No. 3 at around 81s. 6d. East-Coast hematite iron is now being quoted for delivery equal to Manchester at from 80s. to 81s. per ton, according to grade. West-Coast hematite remains at 81s.

MIDLANDS.—New business is not forthcoming in this area as the consumers both of Midland brands and hematite iron are sufficiently covered for a number of months. A few blast-furnaces have actually had to close their order books owing to their being sold so far forward. The Association minimum rates, delivered Birmingham and Black Country stations and subject to rebate to large consumers, are 67s. 6d. per ton for Northants No. 3 and 71s. for Derbyshire, Lincolnshire, and Staffordshire No. 3. General engineering consumers are still taking large volumes of pig-iron and this branch of the trade is particularly good. Low-phosphorus iron including Scottish No. 3 is from 85s. to 90s. with medium-phosphorus from 72s. to 80s., and refined brands at prices ranging from £5 7s. 6d. to £7 delivered this district. Hematite prices are as follow:—West-Coast mixed numbers in foundry grades 84s. 6d. per ton, this being also the price for East-Coast No. 1, with No. 3 at 6d. per ton less. Mixed numbers are quoted by Welsh makers at 83s. per ton.

SCOTLAND.—Pig-iron has a steady demand in all qualities in this district. Basic and hematite are in particularly good demand and there has been some purchasing of these qualities into next year. The price of basic iron has been raised and other advances are feared by consumers. The official price of 70s. f.o.t. furnaces for No. 3 foundry is still in force, with 2s. 6d. per ton added for No. 1 foundry. The light-castings branch of the trade continues to be very satisfactory and prospects, generally, are good. Cleveland iron prices are unchanged at 67s. 3d. f.o.t. Falkirk and 70s. 3d. f.o.t. Glasgow; other English irons are 1s. 3d. per ton less. Prices of steel-making irons remain as follow:—Mixed numbers West-Coast hematite, 71s.; ordinary mixed numbers West-Coast hematite, 75s.; ordinary mixed numbers East-Coast hematite, 77s. 6d.; basic, British and Indian, 70s. (less 5s. rebate), all delivered steelworks here.

Coke

The supplies of coke are large and the increased strength noted in the market a few weeks ago has gone, and the market has become very quiet again. Best Durham coke is at between 34s. and 40s. per ton; Welsh from 31s. up to 43s. 6d., and Scottish low-ash coke in small supplies are entering the district at about 39s. to 40s. All prices are delivered Birmingham and district.

Steel

Business in the steel markets has been rather quiet since the holidays, but this is a seasonal trade movement, and little doubt is entertained that the demand will again become active early in September, says the official report of the London Iron and Steel Exchange. In the semi-finished-steel department steady conditions rule. Deliveries to consuming works are on a substantial scale and a sustained volume of orders is reaching the home producers. Although sales of Continental material are reported in the British market, these appear to have had no influence upon the position. In some cases consumers have covered their requirements for a long period forward. Active conditions continue to rule in the finished-steel market. A slight seasonal decline in the amount of new business is noticeable in some departments, but the producing works are well supplied with orders, and there has been no slackening in operations. Inquiry upon oversea account shows a tendency to increase, but business is still hampered by exchange restrictions.

Scrap

Local steel-makers in the Cleveland district are covering themselves for forward supplies of heavy melting steel, the price of which remains under the cost of production of pig-iron. The delivered price is 52s. 6d. per ton and large volumes are changing hands. Heavy steel turnings are once again in good demand at 37s. 6d. per ton. Cast-iron borings are 27s. 6d. per ton while heavy cast iron and heavy machinery are unchanged at 52s. 6d. and 55s. respectively. The South Wales market is still without much interest and very quiet conditions prevail. Good, heavy, mild-steel scrap in furnace sizes is quiet at 55s. to 56s., and hydraulically-compressed steel shearings are steady in demand at 55s. to 56s. Light cast-iron scrap in small quantities realise 43s. 6d. to 45s. and good cast-iron machinery has a small local demand at 52s. 6d. to 55s. Steady prices have been kept in the Lancashire market, but the demand is, on the whole, affected by the holidays. Good machinery cast-iron scrap ranges from about 47s. 6d. to 52s. 6d. per ton, including delivery to local foundries. Steel scrap is around 52s. 6d., delivered Sheffield basis, and wrought-iron scrap is about 5s., delivered locally. The Scottish market is steady, the turnover being almost normal again. First-quality heavy mild-steel scrap in furnace sizes is unchanged at 50s. and heavy basic or heavy iron and steel scrap mixed is at 45s. Good piling wrought-iron scrap is firm at 57s. 6d. and special quality is around 60s.

Metals

Copper.—The market has been exceptionally quiet during the past week, and the price fluctuations have been very small. The trade demand has decreased considerably, as is usual during August, but it seems more pronounced this year. Consumption is low on account of most users being covered for their early requirements. Interesting figures reported by the American Bureau of Metal Statistics indicate that the consumption of copper in Great Britain has risen by 2,956 metric tons per month for the first half of this year, as compared with the twelve months of 1934. German consumption has risen a little, and that of France, Italy and Japan has also increased by a few thousand metric tons. Only Germany of these countries has a consumption anywhere nearing that of Great Britain.

Daily market prices:—

Cash.—Thursday, £32 2s. 6d. to £32 3s. 9d.; Friday, £32 8s. 9d. to £32 10s.; Monday, £32 13s. 9d. to £32 15s.; Tuesday, £33 2s. 6d. to £33 3s. 9d.; Wednesday, £33 7s. 6d. to £33 8s. 9d.

Three Months. — Thursday, £32 10s. to £32 11s. 3d.; Friday, £32 15s. to £32 16s. 3d.; Monday, £33 1s. 3d. to £33 2s. 6d.; Tuesday, £33 10s. to £33 11s. 3d.; Wednesday, £33 15s. to £33 16s. 3d.

Tin.—The confidence of this market was shaken following the decision of the International Tin Committee to raise the authorised rate of output from 50 to 65 per cent. of the standard rate, but at the beginning of this week there was a spectacular upward movement in prices, due partly to covering of certain near positions and to the fact that the Pool ceased to deal in cash tin. This has increased—in value—since last Thursday from £209 5s. to £226 on Wednesday.

Day-to-day fluctuations:—

Cash.—Thursday, £208 15s. to £209 5s.; Friday, £210 10s. to £210 15s.; Monday, £218 15s. to £219. Tuesday, £222 to £222 10s.; Wednesday, £225 10s. to £226.

Three Months.—Thursday, £208 2s. 6d. to £208 5s.; Friday, £209 to £209 5s.; Monday, £212 to £212 5s.; Tuesday, £214 10s. to £215; Wednesday, £216 5s. to £216 10s.

Spelter.—This market continues to be rather featureless. Business has been slow and consumption has decreased, chiefly on account of the holiday period. The decision of the Customs authorities regarding duties is being eagerly awaited by the market, and a quick declaration is hoped for. The American spelter market reports a steady consumption, but prices remain unchanged.

Official quotations were as follow:—

Ordinary.—Thursday, £14 8s. 9d.; Friday, £14 8s. 9d.; Monday, £14 16s. 3d.; Tuesday, £14 18s. 9d.; Wednesday, £15.

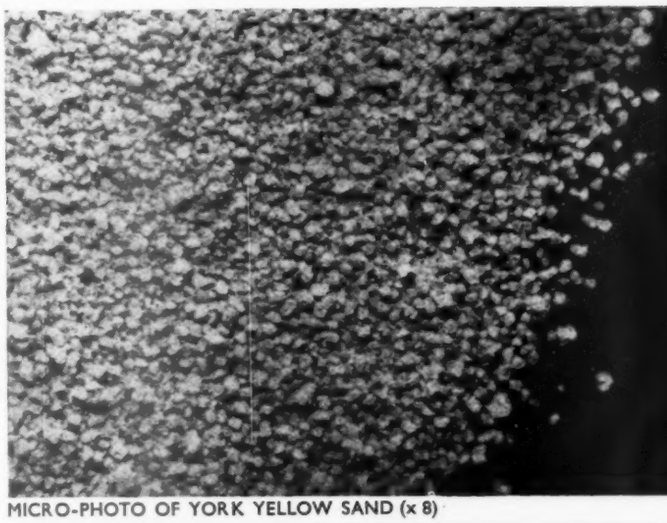
Lead.—A firm tone prevails on the lead market, and the outlook seems favourable. House construction concerns have taken up fair quantities of lead in this country, and military preparations abroad have strengthened the market. The Metallgesellschaft states that the world smelter output declined in June to 106,706 metric tons from 119,882 tons in May. The decline chiefly occurred in the United States, Italy and Spain.

Day-to-day quotations:—

Soft Foreign (Prompt).—Thursday, £15 15s.; Friday, £15 15s.; Monday, £15 17s. 6d.; Tuesday, £15 18s. 9d.; Wednesday, £16 2s. 6d.

53, Victoria Street, Westminster, London, S.W.1.
ACID RESISTING LACQUERS
J. N. CLIFTON
FERRO ALLOYS
Silico Manganese, etc.
Ferro Silicon.
Telegrams: Newclift, Sowest, London.
Telephone: Victoria 1852.
DIAMITE WHEEL DRESSING TOOL
(Agent for London and District).

Moulders who want a sand with that little extra resistance for casting iron and iron alloys at high temperature, and which will produce a good skin on the casting, will find no better medium than York Yellow Sand. It is well bonded, fine in grain, yet permeable and highly refractory.



YORK YELLOW

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	Glasgow Office:	
Central 5250.	156, St. Vincent Street, C.2.	Genefax, Glasgow.

RAW MATERIALS—PRICE LIST

(Wednesday, August 21, 1935)

COPPER

	£	s.	d.
Standard cash	33	7	6
Three months	33	15	0
Electrolytic	36	15	0
Tough	35	0	0
Best selected	35	10	0
Sheets	62	0	0
India	47	0	0
Wire bars	37	0	0
Ingot bars	37	0	0
H.C. wire rods	40	10	0
Off. av. cash, July	31	1	4 11/16
Do., 3 mths., July	31	9	7 7/16
Do., Sttlmnt., July	31	1	7 1/16
Do., Electro, July	34	11	10 3/16
Do., B.S., July	33	16	11 1/2
Do., wire bars, July	34	18	5 1/16
Solid drawn tubes			10d.
Brazed tubes			10d.
Wire			6d.

BRASS

Solid drawn tubes	9½d.
Brazed tubes	11½d.
Rods, drawn	8d.
Rods, extd. or rlld.	4½d.
Sheets to 10 w.g.	7½d.
Wire	7½d.
Rolled metal	7d.
Yellow metal rods	4½d.
Do. 4 × 4 Squares	5½d.
Do. 4 × 3 Sheets	5¾d.

TIN

	£	s.	d.
Standard cash	225	10	0
Three months	216	5	0
English	225	15	0
Bars	223	0	0
Straits (nom.)	224	0	0
Australian (nom.)	222	10	0
Eastern	222	10	0
Banca (nom.)	224	0	0
Off. av. cash, July	232	12	7 9/16
Do., 3 mths., July	233	8	8 5/16
Do., Sttlmt., July	232	14	4 3/16

SPELTER

	£	s.	d.
Ordinary	15	0	0
Remelted	15	10	0
Hard	11	15	0
Electro 99.9	17	13	0
English	16	0	0
India	13	0	0
Zinc dust	19	10	0
Zinc ashes	3	5	0
Off. aver., July	14	2	6
Aver. spot, July	14	1	3 1/16

LEAD

	£	s.	d.
Soft foreign ppt.	16	2	6
Empire (nom.)	17	1	3
English	18	0	0
Off. average, July	14	9	7 11/16
Average spot, July	14	9	0 5/16

ALUMINIUM

Ingots	£100 to £105
Wire	1/1 to 1/9 lb.
Sheet and foil	1/2 to 2/9 lb.

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	23	5	0
Do., V.M. ex-whse.	24	0	0
Rods	29	0	0

ANTIMONY

	£	s.	d.		£	s.	d.
English	74	0	0	to	75	0	0
Chinese, ex-whse.					69	0	0
Crude, c.i.f.					28	10	0

QUICKSILVER

Quicksilver	11	2	6	to	11	12	6

FERRO-ALLOYS AND STEEL-MAKING METALS

Ferro-silicon—	
25%	£8 17 0
45/50%	£12 15 0
75%	£17 17 6
Ferro-vanadium—	
35/50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% carbon-free	4/6 lb. Mo.
Ferro-titanium—	
23/25% carbon-free	9d. lb.
Ferro-phosphorus, 20/25%	£16 0 0
Ferro-tungsten—	
80/85%	3/- lb.
Tungsten metal powder—	
98/99%	3/3 lb.
Ferro-chrome—	
2/4% car.	£33 10 0
4/6% car.	£21 15 0
6/8% car.	£21 0 0
8/10% car.	£21 0 0
Ferro-chrome—	
Max. 2% car.	£34 10 0
Max. 1% car.	£36 5 0
Max. 0.70% car.	£37 5 0
70% carbon-free	9½d. lb.
Nickel—99.5/100%	£200 to £205
"F" nickel shot	£184 0 0
Ferro-cobalt, 98/99%	5/6 lb.
Metallic chromium—	
96/98%	2/5 lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0 to 11 5 0
76/80% packed	£11 15 0 to 12 5 0
76/80% export	(nom.) £9 15 0
Metallic manganese—	
94/96% carbon-free	1/3 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 7/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ¼ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

South Wales—	£	s.	d.		£	s.	d.
Heavy steel	2	15	0	to	2	16	0
Bundled shrngs.	2	7	6	to	2	15	0
Mixed iron and steel	2	10	0	to	2	11	0
Heavy cast iron	2	10	0	to	2	12	0
Good machinery	2	12	6	to	2	15	0

Cleveland—	£	s.	d.
Heavy steel	2	12	6
Steel turnings	1	17	6
Cast-iron borings	1	7	6
Heavy cast iron	2	12	6
Heavy machinery	2	14	0 to 2 15 0

Midlands—	£	s.	d.
Light cast-iron scrap	2	7	6
Heavy wrought iron	2	17	6
Steel turnings	1	14	0

Scotland—	£	s.	d.
Heavy steel	2	10	0
Ordinary cast iron	2	11	6
Engineers' turnings	1	19	6
Cast-iron borings	1	17	0 to 1 18 6
Wrot-iron piling	2	17	6
Heavy machinery	2	16	6

London—Merchants' buying prices, delivered yard.

	£	s.	d.
Copper (clean)	27	0	0
Brass	18	0	0
Lead (less usual draft)	14	0	0
Tea lead	10	0	0
Zinc	9	10	0
New aluminium cuttings	67	0	0
Braziery copper	23	0	0
Gunmetal	25	0	0
Hollow pewter	150	0	0
Shaped black pewter	116	0	0

PIG-IRON

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	70/-
Foundry No. 3	67/6
,, at Falkirk	67/3
,, at Glasgow	70/3
Foundry No. 4	66/6
Forge No. 4	66/6
Hematite No. 1	71/-
Hematite M/Nos.	70/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	75/-
,, d/d Birm.	84/6
Malleable iron d/d Birm.	115/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	67/-
,, No. 3 fdry.	71/-
Northants forge	63/6
,, fdry. No. 3	67/6
,, fdry. No. 1	70/6
Derbyshire forge	67/-
,, fdry. No. 3	71/-
,, fdry. No. 1	74/-
Scotland—	
Foundry No. 1, f.o.t.	72/6
,, No. 3, f.o.t.	70/-
Hem. M/Nos. d/d	71/-
Sheffield (d/d district)—	
Derby forge	64/6
,, fdry. No. 3	68/6
Lincs forge	64/6
,, fdry. No. 3	68/6
W.C. hematite	86/-
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	74/-
Staffs fdry. No. 3	74/-
Northants fdry. No. 3	72/6
Cleveland fdry. No. 3	74/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	81/6
Clyde, No. 3	81/6
Monkland, No. 3	81/6
Summerlee, No. 3	81/6
Eglinton, No. 3	81/6
Gartsherrie, No. 3	81/6
Shotts, No. 3	81/6

FINISHED IRON AND STEEL

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£	s.	d.		£	s.	d.
Bars (cr.)	9	12	6	to	9	15	0
Nut and bolt iron	7	10	0	to	8	0	0
Hoops	£10 10 0 and up.						
Marked bars (Staffs)	f.o.t. 12 0 0						
Gas strip	10 10 0 and up.						
Bolts and nuts, ¾ in. × 4 in.	14 2 6 and up.						

Steel—	£	s.	d.		£	s.	d.
Plates, ship, etc.	8	15	0	to	8	17	6
Boiler plts.	9	5	0	to	9	7	6
Chequer plts.	£10 7 6						
Angles	£8 7 6						
Tees	£9 7 6						
Joists	£8 15 0						
Rounds and squares, 3 in. to 5½ in.	£9 7 6						
Rounds under 3 in. to ¾ in. (Untested)	£8 12 0						
Flats—8 in. wide and over	£8 12 6						
,, under 8 in. and over 5 in.	£8 17 6						
Rails, heavy	8	5	0	to	8	10	0
Fishplates	12	5	0	to	12	10	0
Hoops (Staffs)	£9 7 0						
Black sheets, 24g. (4-t. lots)	£11 0 0						
Galv. cor. shts. (,,)	£13 0 0						
Galv. flat shts. (,,)	£13 10 0						
Galv. fencing wire, 8g. plain	£14 10 0						
Billets, soft	£5 10 0 and up.						
Billets, hard	6	17	6	to	7	2	6
Sheet bars	5	5	0	to	5	10	0
Tin bars	5	5	0	to	5	10	0

PHOSPHOR BRONZE

	Per lb. basis.
Strip	9½d.
Sheet to 10 w.g.	11½d.
Wire	11½d.
Rods	11d.
Tubes	13½d.
Castings	12d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	20.31
No. 2 foundry, Valley	18.50
No. 2 foundry, Birm.	14.50
Basic, Valley	18.00
Malleable, Valley	18.50
Grey forge, Valley	18.00
Ferro-mang. 80%, seaboard	85.00
O.-h. rails, h'y, at mill	36.37½
Billets	27.00
Sheet bars	28.00
Wire rods	38.00
	Cents.
Iron bars, Chicago	1.80
Steel bars	1.80
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.70
Steel hoops	2.10
Sheets, black, No. 24	2.40
Sheets, galv., No. 24	3.10
Wire nails	2.60
Plain wire	2.30
Barbed wire, galv.	3.00
Tinplates, 100-lb. box	$5.25

COKE (at ovens)

Welsh foundry	25/- to 30/-
,, furnace	19/- to 20/-
Durham foundry	20/- to 21/-
,, furnace	16/6 to 17/9
Scotland, foundry	28/-
,, furnace	25/-

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box		18/2 and up.
,,	28×20	,,	36/4 and up.
,,	20×10	,,	26/- to 26/3
,,	18¾×14	,,	18/9 to 19/-
C.W.	20×14	,,	15/6
,,	28×20	,,	32/6
,,	20×10	,,	22/9
,,	18¾×14	,,	15/6

SWEDISH CHARCOAL IRON & STEEL

Pig-iron	£6 0 0 to £7 0 0
Bars-hammered, basis	£16 0 0 to £16 10 0
Bars and nail-rods, rolled, basis	£15 15 0 to £16 0 0
Blooms	£10 0 0 to £12 0 0
Keg steel	£30 0 0 to £31 0 0
Faggot steel	£18 0 0 to £23 0 0
Bars and rods dead soft, st'l	£10 0 0 to £12 0 0

All per English ton, f.o.b. Gothenburg
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

	£	s.	d.		
Aug. 15 ..	32	2	6	inc.	5/-
,, 16 ..	32	8	9	,,	6/3
,, 19 ..	32	13	9	,,	5/-
,, 20 ..	33	2	6	,,	8/9
,, 21 ..	33	7	6	,,	5/-

Electrolytic Copper

	£	s.	d.		
Aug. 15 ..	35	10	0	inc.	2/6
,, 16 ..	35	10	0	No	change
,, 19 ..	36	0	0	inc.	10/-
,, 20 ..	36	10	0	,,	10/-
,, 21 ..	36	15	0	,,	5/-

Standard Tin (cash)

	£	s.	d.		
Aug. 15 ..	208	15	0	dec.	45/-
,, 16 ..	210	10	0	inc.	25/-
,, 19 ..	218	15	0	,,	165/-
,, 20 ..	222	0	0	,,	65/-
,, 21 ..	225	10	0	,,	65/-

Tin (English ingots)

	£	s.	d.		
Aug. 15 ..	209	5	0	dec.	45/-
,, 16 ..	210	10	0	inc.	35/-
,, 19 ..	219	0	0	,,	170/-
,, 20 ..	222	0	0	,,	60/-
,, 21 ..	225	15	0	,,	75/-

Spelter (ordinary)

	£	s.	d.		
Aug. 15 ..	14	8	9	inc.	2/6
,, 16 ..	14	8	9	No	change
,, 19 ..	14	16	3	inc.	7/6
,, 20 ..	14	18	9	,,	2/6
,, 21 ..	15	0	0	,,	1/3

Spelter (Electro, 99.9 per cent.)

	£	s.	d.		
Aug. 15 ..	17	1	3	inc.	2/6
,, 16 ..	17	1	3	No	change
,, 19 ..	17	8	9	inc.	7/6
,, 20 ..	17	11	3	,,	2/6
,, 21 ..	17	13	0	,,	1/9

Zinc Sheets (English)

	£	s.	d.		
Aug. 15 ..	22	15	0	inc.	2/6
,, 16 ..	22	15	0	No	change
,, 19 ..	23	2	6	inc.	7/6
,, 20 ..	23	5	0	,,	2/6
,, 21 ..	23	5	0	No	change

Lead (English)

	£	s.	d.		
Aug. 15 ..	17	15	0	No	change
,, 16 ..	17	15	0	,,	,,
,, 19 ..	17	15	0	,,	,,
,, 20 ..	18	0	0	inc.	5/-
,, 21 ..	18	0	0	No	change

Imports and Exports of Pig-Iron, Iron and Steel Castings, etc., in July and the seven months, 1935, compared with a year ago.

	July.		Seven months.		July.		Seven months.	
	1934.	1935.	1934.	1935.	1934.	1935.	1934.	1935.
	Tons.	Tons.	Tons.	Tons.	£	£	£	£
Imports.								
Pig-iron—from British India	8,784	4,300	57,748	43,225	25,311	13,054	159,741	131,044
,, Foreign Countries	2,124	674	9,206	8,008	10,723	3,720	51,817	46,785
Total	10,908	4,974	66,954	51,233	36,034	16,774	211,558	177,829
Castings and forgings	398	318	2,388	1,673	9,999	8,144	60,019	43,251
Cast pipes and fittings	58	340	713	956	3,813	5,057	39,268	22,692
Stoves, grates, etc.	77	254	505	783	7,427	15,378	48,654	63,886
Baths	565	804	4,396	4,094	15,034	21,281	107,876	110,409
Hollow-ware, all kinds	156	195	1,440	1,477	10,235	12,985	80,652	99,288
Exports.								
Pig-iron, forge	65	188	654	929	277	858	2,725	4,163
,, foundry	6,458	8,545	41,092	54,508	21,708	27,397	140,721	188,555
,, acid	2,074	3,249	25,764	29,528	6,653	10,540	81,537	96,000
,, basic	30	—	808	231	113	—	2,636	727
Total	8,627	11,982	68,318	85,286	28,751	38,795	227,619	289,445
Castings and forgings	376	457	2,837	2,511	15,130	14,767	107,032	95,445
Cast pipes and fittings, up to 6 in. diameter	5,808	4,739	36,818	32,700	61,356	52,331	404,292	360,992
,, ,, ,, over 6 in.	2,688	2,228	22,299	21,764	19,744	19,611	166,639	169,209
Stoves, grates, etc.	646	696	4,825	4,824	35,352	37,409	232,833	241,942
Sanitary cisterns	306	292	1,741	1,821	8,695	9,333	51,199	52,910
Bedsteads, inc. tubes therefor	353	344	2,994	2,442	11,896	11,981	98,860	90,050
Cast hollow-ware	324	368	2,016	2,254	12,090	12,892	76,690	86,446

WILLIAM JACKS & COMPANY,
WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.
13, RUMFORD STREET, LIVERPOOL.

PIG IRON

REGISTERED TRADE MARK
LIMPET

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,
CENTRAL CHAMBERS, 93, HOPE ST., GLASGOW, C.2.
ZETLAND ROAD, MIDDLESBROUGH.

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(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED

FOREMAN BRASS-MOULDER seeks change. 20 years in control. Experience in all non-ferrous work. Modern methods of production. Full knowledge of estimating and contracting. Clean record with well-known firms.—Box 348, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRYMAN desires change, country or abroad. Theory and Practice of Machine, Floor, in Iron, Steel, Aluminium, General Engineering work; good disciplinarian.—Box 350, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

BATH Manufacturers, Midland Area, require experienced man to control enamelling department; must be fully experienced; only first-class practical men need apply. Applications treated in strict confidence.—Reply giving fullest particulars and salary required to Box 352, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

THE Stanton Ironworks Company, Limited, near Nottingham, require an assistant salesman in their pig-iron department in London.—Reply Secretary, care of above, stating age, experience, and knowledge of the trade.

WANTED.—A Foreman Moulder for the Iron and Steel Foundries of a large firm of Engineers in India. Age between 25-30. Only those need apply who possess sound experience of heavy and light iron castings and are thoroughly conversant with machine, dry, green and loam moulding practice, with a knowledge of patternmaking. It is desirable that applicants should have experience of Steel Foundry moulding work also.—Applications in writing with full details of experience, stating age and whether married or single, and copies of references should be addressed to "Moulder," c/o W. ABBOTT, LIMITED, 32, Eastcheap, London, E.C.3.

WANTED, Chargehand for Iron Foundry, used to high-class Engine Castings, also medium and small work; accustomed to piecework.—Only first-class men need apply, in writing, stating age, experience and salary required to MESSRS. J. BROWETT-LINDLEY (1931), LIMITED, Coborn Works, Letchworth, Herts.

EMPLOYMENT REGISTER.

Conducted by the Institute of British Foundrymen by courtesy of the proprietors of THE FOUNDRY TRADE JOURNAL.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

Any employer wishing to communicate with a candidate should write to the General Secretary, quoting identification number.

FOREMAN requires similar position or as Assistant Foreman. Engineering, machine-tool and millwright castings, cupola practice, high-duty cast iron; accustomed to systems of payment by result. (266)

PUBLICATION

RYLAND'S DIRECTORY of the Coal, Iron, Steel, Tinplate, Metal, Engineering, Hardware and Allied Trades. A new edition will be going to press soon. *Write now* for full particulars and advertisement rates.—INDUSTRIAL NEWSPAPERS, LIMITED, 49, Wellington Street, Strand, London, W.C.2.

MACHINERY

WANTED. Must be in good working order. One Ronceray Mill, BMC240, approx. 7 ft. dia., capacity 15 tons.—Box 340, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOR SALE. Jackman No. 4 Cupola, rated capacity 6/7 tons, in good condition; £75. Apply E. HIND, Imperial Works, South Bank-on-Tees.

NEW Dwarf Cupola, to melt 10 to 15 cwts. per hr. New Worm-geared Ladles, 5 tons, 25 cwts., 15 cwts. and 10 cwts. capacity. Ungeared Ladles, 15 cwts. and 10 cwts. capacity. Improved Cupola Spark Arresters.—T. DAVIES & SON, West Gorton, Manchester.

SANDBLAST PLANTS

Room Plants, sizes 12 ft. x 12 ft., 12 ft. x 9 ft. and 6 ft. x 6 ft., made up in cast-iron sections.

Barrel Plants, 30 in. dia. x 36 in. long and 30 in. dia. x 18 in. long rotary barrels.

Cabinet Plants, in sizes 4 ft. x 4 ft. x 4 ft., 36-in. dia. and 30-in. dia. operators' cabinets.

Most of the above by Tilghman and complete with Air Compressors.

HAND MOULDING MACHINES

By Adaptable, Pridmore, Darling & Sellars, etc.; Squeezers by Utard (unused), Samuelson and Britannia, also Farwell Universal Type.

Ladles, Grinding Machines, Exhaust Fans, Blowers, Air Compressors and 500 Electric Motors and Dynamos.

S. C. BILSBY, A.M.I.C.E., A.M.I.E.E.

CROSSWELLS ROAD (Adjoining Railway Crossing), LANGLEY, Nr. Birmingham.
'Phone: Broadwell 1359.

THOS. W. WARD LTD.

9½" cen. S.S. & Sc. LATHE (Scott), on 8' 0" gap bed; admits 4' 3"; 1½" dia.; hollow spindle; swing in gap 38" dia. x 9".

Belt dr. ANGLE CROPPING Machine (Berry), for 3½" x 3½" angles with hold-down; 42" dia. flywheel; 20" dia. f. and l. pulleys.

BABCOCK W.T. BOILER, of 4,356 sq. ft. heating surface, 150 lbs. w.p.

Secondhand "Lister" PETROL TRUCK, overhauled and in good working order.

Write for "Albion" Catalogue.

'Grams: "Forward." 'Phone: 23001 (10 lines).
ALBION WORKS, SHEFFIELD.

'Phone: 287 SLOUGH

SAND PLANT

Herbert Whizzer, large size. **£48.**
Brealey Disintegrator, NEW. **£26.**
Pneumatic Riddles, Jackman type. **£9 each.**

SANDBLAST PLANT

BARRELL PLANT by Tilghman, *as new*, 60" × 40". Price **£240.**

NEW 8' × 8' ROOM PLANT, complete. Price **£230.**

CAST IRON ROOM PLANT, 12' × 9', complete with 400 cu. ft. motor-driven compressor for A.C. current, in new condition. Cheap.

Several small complete barrell plants in stock.

Genuine Stevenson 30-ton Crane Ladle, NEW. Price **£75.**

BUY FROM ME AND SAVE MONEY!

ALEX. HAMMOND, *Foundry Machinery Merchant,*
14, AUSTRALIA ROAD, SLOUGH

MISCELLANEOUS

FLUIDITY TESTS as described in THE FOUNDRY TRADE JOURNAL, February 1, 1934. Patterns of the above in aluminium can be supplied for 35s. per set. Post free. We can also supply Patterns for all branches of the engineering trade, in hard or soft woods. Send us your inquiries. — FURMSTON & LAWLOR, Patternmakers, Letchworth, Herts.

SELECT YOUR MACHINE FROM THE LARGEST STOCK OF HIGH CLASS SECONDHAND MOULDING MACHINES IN THE WORLD

Practical Advice Free

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The ASTBURY SILICA CO.
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PRIME & PATTERN GRADES
½" to 3" thick
Width up to 24" wide
All free of centre heart and shake

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Metropolitan 7418